# Implications of Electronic Mail and Message Systems for the U.S. Postal Service

CONGRESS OF THE UNITED STATES
**Office of Technology Assessment**
Washington, D.C. 20510

J952-42

# Office of Technology Assessment

## Congressional Board of the 97th Congress

TED STEVENS, *Alaska, Chairman*

MORRIS K. UDALL, *Arizona, Vice Chairman*

**Senate**

ORRIN G. HATCH
*Utah*

CHARLES McC. MATHIAS, JR.
*Maryland*

EDWARD M. KENNEDY
*Massachusetts*

ERNEST F. HOLLINGS
*South Carolina*

HOWARD W. CANNON
*Nevada*

**House**

GEORGE E. BROWN, JR.
*California*

JOHN D. DINGELL
*Michigan*

LARRY WINN, JR.
*Kansas*

CLARENCE E. MILLER
*Ohio*

COOPER EVANS
*Iowa*

JOHN H. GIBBONS
*(Nonvoting)*

## Advisory Council

CHARLES N. KIMBALL, *Chairman*
*Midwest Research Institute*

EARL BEISTLINE
*University of Alaska*

CHARLES A. BOWSHER
*General Accounting Office*

CLAIRE T. DEDRICK
*California Land Commission*

JAMES C. FLETCHER
*University of Pittsburgh*

S. DAVID FREEMAN
*Tennessee Valley Authority*

GILBERT GUDE
*Congressional Research Service*

CARL N. HODGES
*University of Arizona*

RACHEL McCULLOCH
*University of Wisconsin*

WILLIAM J. PERRY
*Hambrecht & Quist*

DAVID S. POTTER
*General Motors Corp.*

LEWIS THOMAS
*Memorial Sloan-Kettering
Cancer Center*

## Director

JOHN H. GIBBONS

The Technology Assessment Board approves the release of this report. The views expressed in this report are not necessarily those of the Board, OTA Advisory Council, or of individual members thereof.

# Implications of Electronic Mail and Message Systems for the U.S. Postal Service

**OTA Reports** are the principal documentation of formal assessment projects. These projects are approved in advance by the Technology Assessment Board. At the conclusion of a project, the Board has the opportunity to review the report but its release does not necessarily imply endorsement of the results by the Board or its individual members.

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D. C. 20510

Library of Congress Catalog Card Number 82-600599

For sale by the Superintendent of Documents,
U.S. Government Printing Office, Washington, D.C. 20402

# Foreword

This study of the implications of electronic mail and message systems (EMS) for the U.S. Postal Service (USPS) is one of four components of the OTA assessment of Societal Impacts of National Information Systems. It should be read along with the September 1981 OTA report on *Computer-Based National Information Systems: Technology and Public Policy Issues,* which provides the larger context for understanding EMS-related public policy questions. Also relevant is the March 1982 OTA background paper on *Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity.*

The House Committee on Post Office and Civil Service, one of the original requesting committees, indicated an interest in the possible impact of EMS and electronic funds transfer (EFT) on the USPS mailstream and labor force, and implications for the future role of USPS in electronic mail and message systems. The Senate Committee on Governmental Affairs, Subcommittee on Civil Service, Post Office, and General Services, expressed a similar interest. In response, OTA initiated a review of relevant EMS and EFT developments since the completion of the work of the Commission on Postal Service in 1977. Several working papers and computer-based models were developed by OTA staff and contractors. These were reviewed by an OTA advisory panel representing postal, labor, telecommunication carrier, computer service, business, academic, and consumer interests. On the basis of that review, a revised and integrated report was prepared.

OTA appreciates the participation of the advisory panelists, external reviewers, and others who helped bring this study to fruition. It is, however, solely the responsibility of OTA, not of those who so ably advised and assisted in its preparation.

John H. Gibbons

JOHN H. GIBBONS
*Director*

# OTA Electronic Message Systems Advisory Panel

Susan Nycum, *Chairwoman*
Attorney at Law, Gaston Snow & Ely Bartlett

Roy Amara
President
Institute for the Future

Paul Baran
President
Cabledata Associates

Harold P. Belcher
General Manager for Advanced Mail R&D
U.S. Postal Service

Robert L. Chartrand, *ex officio*
Senior Specialist in Information Technology and Policy
Congressional Research Service

Kent W. Colton
Professor of Public Management
Brigham Young University

Donald Dunn
Professor of Engineering-Economic Systems
Stanford University

Lawrence J. Gervais
**Former Vice President**
American Postal Workers Union

Maurice W. Gregg
Senior Vice President for Finance
The Gap Stores, Inc.

Jeremiah Gutman
Attorney at Law
Levy, Gutman, Goldberg & Kaplan

J. Robert Harcharik
**Former President**
Tymnet, Inc.

Rob Kling
Professor of Information and Computer Science
University of California at Irvine

John C. LeGates*
Director, Information Resources Policy Program
Harvard University

Henry Lucas
Chairman and Professor of Computer Applications and Information Systems
New York University

Daniel McCracken
Past President
Association for Computing Machinery

Arthur S. Miller
Professor of Law Emeritus
The George Washington University

Sharon Nelson
Attorney at Law
**Consumers Union (formerly)**

Phil Nyborg
Former General Counsel
Computer and Communications Industry Association

Russell Pipe
President
Transnational Data Reporting Service, Inc.

Ithiel De Sola Pool
Professor of Political Science
Massachusetts Institute of Technology

James Rule
Professor of Sociology
State University of New York at Stony Brook

Richard M. Schmidt
General Counsel
American Society of Newspaper Editors

Sherry Turkle
Program in Science, Technology, and Society
Massachusetts Institute of Technology

Ron Uhlig
Manager, Business and Services Planning
Bell Northern Research Laboratory

Jacques Vallee
President
Infomedia

Carl Vorlander
Executive Director
National Association for State Information Systems

Fred W. Warden
Former Director, Telecommunication Relations
IBM Corp.

Willis Ware
Senior Computer Specialist
The Rand Corp.

Iram Weinstein
System Planning Corp.

Alan F. Westin
Professor of Political Science
Columbia University

---

*Resigned in late 1979.

## OTA Electronic Message Systems Project Staff

John Andelin, *Assistant Director, OTA*
*Science, Information, and Natural Resources Division*

Sam Hale, *Interim Program Manager*
*Communication and Information Technologies**

Fred B. Wood, *Project Director***

Jean E. Smith, *Study Coordinator*

Zalman A. Shavell, *Senior Analyst*

Fred W. Weingarten, *Senior Analyst*

Elizabeth A. Emanuel, *Administrative Assistant*

Shirley A. Gayheart, *Secretary*

Jeanette Contee, *Wordprocessor*

### Contractors

Charles C. Joyce, Jr., and Jeffrey Held,
Richard L. Deal & Associates, Inc.
Renee G. Ford, Tifford Producers, Ltd.
Keith Geeslin, Walter Hinchman Associates, Inc.
Marvin A. Sirbu, Jr., Massachusetts Institute of Technology
Michael F. Cavanagh, Cavanagh Associates
Robert Anthony, Mitre Corp.
Robert Johansen, Institute for the Future
Harley W. Radin, Consultant

## OTA Publishing Staff

John C. Holmes, *Publishing Officer*

John Bergling    Kathie S. Boss    Debra M. Datcher    Joe Henson

---

*March 1981 through February 1982; Stephen E. Doyle served as Program Manager through February 1981; Fred W. Weingarten was appointed Program Manager effective March 1982.

**Since June 1979; Ruann E. Pengov served as Project Director through May 1979.

# Acknowledgments

The following individuals also contributed as reviewers or provided assistance during the course of this study.

William F. Bolger, The Postmaster General, and staff members of the U.S. Postal Service
Ronald G. Carr, U.S. Department of Justice
Kathleen Casey, GTE-Telenet Communications Corp.
Henry B. Freedman, Policy Studies Corp.
Dean Gillette, Bell Telephone Labs, Inc.
Henry H. Hitchcock, J. F. Coates, Inc.
Herbert N. Jasper, Ad Hoc Committee for Competitive Telecommunications
John F. McLaughlin, Harvard University
Arnim H. Meyburg, Cornell University
Roger K. Salaman, National Telecommunications and Information Administration
Stephen L. Sharfman, Postal Rate Commission
Jack D. Smith, Federal Communications Commission
Scott K. Socol, Satellite Business Systems
Frederic Withington, Arthur D. Little, Inc.

# Contents

*Chapter* *Page*

Overview ix

1. Summary 3
2. Background and Purpose of Study 15
3. Market Penetration Model and Technology Assumptions 23
4. Market Penetration Results 37
5. Revenue/Cost Model and Results 51
6. Implications for Postal Rates, Service Levels, and Labor Requirements 61
7. Implications for the Telecommunication and Computer Industries, EMS Privacy and Security, and USPS Long-Term Viability 73
8. Congressional Policy Considerations 87

*Appendix* *Page*

A. Supplemental Detail on the Market Penetration Model 101

B. Logistic Substitution Process 105

C. Equation Used to Calculate Labor Requirements 107

D. E-COM Interconnection Arrangements 108

Index 111

# Overview

Advances in communication and computer technology provide new ways to convey messages and carry out financial transactions. These are called electronic mail and message systems (EMS) and electronic funds transfer (EFT) systems. Commercially offered EMS and EFT will increasingly compete with portions of the traditional market of the U.S. Postal Service (USPS). While there is disagreement on how fast EMS and EFT may develop, it seems clear that **two-thirds or more of the current mailstream could be handled electronically,** and that **the volume of USPS-delivered mail is likely to peak in the next 10 years.** Any decline in the volume of mail has significant implications for future postal rates, USPS service levels, and labor requirements.

**A key policy issue requiring congressional attention is how USPS will participate in the provision of EMS services,** both in the near term and in the longer term. If USPS does not attract and keep a sizable share of the so-called Generation II EMS market (electronic input and transmission with hardcopy output) and conventional (especially first-class) mail volume declines, USPS revenues will probably go down, with the likelihood of an unfavorable impact on rates and/or service levels. If USPS does develop a major role in the Generation II EMS market, and if Generation II EMS costs are low enough, the effect on USPS rates and/or service could be favorable.

Two of the major factors influencing USPS labor demand are total mail volume and worker productivity. Regardless of whether USPS participates in Generation II EMS, improving worker productivity and eventually declining conventional mail volumes could lead to considerably lower labor demands in the future. If USPS does participate successfully in Generation II EMS, this potential decline in labor requirements could be deferred or partially offset.

USPS is already involved in EMS to a limited extent. For example, it delivers some industry EMS hardcopy, provides a portion of Western Union's Mailgram service, and in January 1982 introduced a domestic service called "electronic computer-originated mail" or E-COM. (In E-COM, USPS accepts letters in electronic form, converts them to hardcopy, including printing and enveloping, and delivers them.) The role of USPS in EMS activities is already controversial, and it is likely to become more so if its role expands.

As a result of technological advances, historical (and legal and regulatory) distinctions between conventional and electronic mail have blurred, along with the application of the the congressional mandates embodied in the Postal and Communications acts. **Absent congressional action to provide a clear direction for USPS and to clarify or redefine regulatory boundaries, the controversy over the USPS role in EMS is likely to continue indefinitely and Generation II EMS opportunities for USPS, private telecommunication carriers, and mailers may be lost.**

OTA identified a number of areas related to USPS participation in EMS that warrant congressional consideration:

- **Potential Contribution to USPS Mail Volume.**—A USPS role in Generation II EMS has the potential to provide a volume "cushion" to partially offset reductions in conventional mail. Since private firms are neither willing nor able to duplicate the nationwide physical delivery infrastructure of USPS, any large-scale Generation II EMS service depends on the participation of USPS. There is, however, little consensus on what USPS role would be most conducive to growth of Generation II traffic (and hence USPS mail volume).

- **Potential Contribution to USPS Finances.**—While Mailgram apparently provides both a substantial avoidance of conventional USPS mailstream costs and a significant contribution to covering USPS fixed costs, it is not clear whether E-COM would do likewise at current rates and in its present configuration. All parties, including USPS, agree that the original E-COM cost estimates prepared in 1978 for the Postal Rate Commission are now outdated. A comprehensive cost review of E-COM is needed if its contribution to USPS finances is to be understood.
- **Impact on USPS Labor Force.**—USPS labor force requirements are sensitive to mail volume. Any significant decline in mail volume for whatever reasons (e.g., diversion to EMS and EFT, competition from nonelectronic alternative delivery services, reduced demand due to general economic recession) would translate into labor force reductions beyond those that may be needed as a result of higher worker productivity.

  USPS participation in Generation II EMS would have two effects on USPS labor requirements. A small number of new jobs would be created to carry out EMS-related activities, and a considerably larger number of jobs would be required in traditional USPS activities to process and deliver the resulting hardcopy. Thus, USPS participation could offset, or at least defer, some of the reductions in the existing labor force that might otherwise be necessary. The need for sizable reductions from the present level of employees is not likely to be felt until the late 1980's or early 1990's.
- **Size and Nature of the E-COM Market.**—OTA concluded that prior estimates of the Generation II market have probably been high, and that prudent planning should be based on a mature market (20 years hence) in the range of 7 billion to 17 billion messages annually, rather than 25 billion as previously estimated by RCA (for comparison, conventional mail in 1981 totaled 110 billion pieces). Even the lower estimate depends on mailer acceptance and successful institutional marketing strategies. Several modifications to E-COM have been proposed that deserve consideration, such as 1-day guaranteed delivery rather than 2-day, flexible letter formats, and the use of telecommunication carrier and mailer logos to personalize the E-COM output and provide incentives for aggressive marketing. A full review of the E-COM market should include governmental as well as private sector mailing needs.
- **Impact on Competition.**—USPS believes its participation in E-COM is authorized by the Postal Reorganization Act mandate to use new facilities and equipment to improve the convenience, efficiency, and cost effectiveness of mail service. However, various telecommunication and computer firms view E-COM as: 1) the entry of a Federal agency into competition with private industry; 2) possibly subject to the Communications Act as well as the Postal Act; and 3) raising questions about the fairness and legality of a USPS role in EMS in general. The applicability of the Private Express Statutes to delivery of Generation II EMS hardcopy output has also been challenged.
- **Regulatory Jurisdiction.**—The E-COM case has surfaced disagreements over the division and extent of regulatory jurisdiction by the Postal Rate Commission and Federal Communications Commission. As a result, USPS brought suit against both commissions and the Department of Justice brought suit against USPS—all on jurisdictional grounds, not on the merits or faults of E-COM. Some private firms believe this demonstrates the dif-

ficulty of regulating USPS ratesetting and preventing the potential cross-subsidization of E-COM from conventional mail revenues. One proposed response to that concern would be to require a separate USPS entity for any EMS offering.

- **E-COM Privacy and Security.**—The involvement of USPS in E-COM has pointed out the need for additional security measures to protect the privacy of EMS messages. The Postal and/or Communications Act may need to be amended to provide additional statutory privacy protection.
- **Role in Telecommunication and/or Generation III EMS.**—The USPS role in E-COM does not involve either telecommunication or electronic delivery. Whether there are conditions that would constitute demonstrated need for USPS to contract with a telecommunication carrier to transmit messages electronically on behalf of USPS needs to be clarified. Further study seems warranted on the possible use of EMS Generation III (as well as Generation II) to help USPS maintain adequate service levels to rural and less populated areas and to low volume, nonprofit, and educational mailers (E-COM is currently designed for high-volume business mailers.)
- **Increased Cooperation with the Private Sector.**—At present, it is difficult for USPS to conduct effective long-range planning and market testing of EMS, since this requires good working relationships with private telecommunication and computer firms. If some clearer consensus can be reached on the direction and limits of USPS involvement in EMS, perhaps a more constructive relationship with the private sector can develop.

OTA's analysis suggests that advances in technology and increased competition in the communications marketplace will significantly affect USPS finances, service levels, and labor force requirements over the next two decades. It further suggests that modification or clarification of the USPS role in EMS can, in turn, help determine how effectively USPS accommodates to these changes. Given the difficulty of modifying institutions as large and complex as USPS and the laws and regulations that govern USPS actions, it would seem prudent for Congress and USPS to address these issues aggressively. Changes are taking place so fast in the so-called "communications revolution" that by the time USPS actually experienced significant reductions in conventional mail volume, most opportunities for participation in EMS would have passed and it would be much more difficult to adjust.

# Chapter 1

# Summary

# Contents

Page
Introduction . . . . 3
USPS Mailstream . . . . 4
USPS Rates and Service Levels . . . . 5
Labor Requirements . . . . 7
Policy Implications . . . . 8
  Provide a Clear Direction for USPS Involvement in EMS . . . . 9
  Reduce or Eliminate Further Regulatory and Judicial Delay . . . . 10
  Strengthen Privacy and Security Protection . . . . 10
  Maintain Oversight and Initiate Planning on USPS Long-Term Viability . . . . 11

## Chapter 1

# Summary

## Introduction

This study addresses three major questions:

1. To what extent are privately offered electronic mail and message systems (EMS) and electronic funds transfer (EFT) systems likely to affect the volume of mail handled by the U.S. Postal Service (USPS)?
2. Are changes in USPS mail volume likely to lead to significant adjustments in USPS rates, service levels, and/or labor force requirements? and
3. What are the implications of EMS for the future of USPS and how it might participate in the provision of EMS services?

These questions are of concern because historically USPS has served a variety of social purposes mandated by Congress, such as "to bind the Nation together through the personal, educational, literary, and business correspondence of the people" and to provide mail service "to (postal) patrons in all areas . . . and all communities," including rural areas, communities, and small towns (Postal Reorganization Act of 1970). In recent years, there has been a continuing revolution in computer and communication technology, a gradual deregulation of the telecommunication industry (the computer industry being essentially unregulated), and a proliferation of new and old firms offering or planning to offer EMS and EFT services that compete with portions of the traditional USPS market. Technology is, in effect, blurring the historical (and legal and regulatory) distinctions between conventional and electronic mail.

USPS is already involved in EMS to a limited extent. It currently delivers some industry EMS hardcopy output, provides a portion of Western Union's Mailgram service, and in January 1982 introduced a domestic service called "electronic computer-originated mail" or E-COM. However, the role of USPS in EMS in general, and in E-COM in particular, continues to be in dispute before various regulatory agencies, the courts, and Congress. USPS believes its participation in EMS is authorized by the Postal Reorganization Act mandate to use new facilities and equipment to improve the convenience, efficiency, and cost effectiveness of mail service. Various mailer organizations, consumer groups, and postal labor unions see a USPS role in EMS as essential to USPS long-term viability and to maintaining, or at least minimizing any reductions in, mail services that are vital to a large part of the U.S. population. They point to the critical role of USPS in providing a universal, low-cost, nondiscriminatory nationwide communication service. Various private telecommunication and computer firms view USPS involvement in EMS as the entry of a Federal agency into competition with private industry (possibly subject to the Communications Act as well as the Postal Act), raising difficult questions of ratesetting and potential cross-subsidy.

There are no easy answers to the questions addressed in this study. Prior studies have proven to be oversimplified. In order to better understand the complexities involved, OTA used computer-based models to project independently the levels of conventional and electronic mail volumes under different sets of assumptions, and to project the possible effects of changes in USPS mail volumes on USPS rates, service levels, and labor requirements. Still, while computer modeling permits consideration of a larger number of variables and interrelationships than would otherwise be possible, the precision of the projections can be misleading. The models are highly sensitive to initial assumptions and have limited ability to anticipate unexpected events. *The study as a whole, and the use of computer modeling in particular, is intended* *to help Congress better understand the possible implications of EMS for USPS, and is not intended to make a prediction of the future course of events.*

## USPS Mailstream

To a substantial extent, the volume of USPS-delivered mail in the future is beyond the direct control of USPS. It will be affected by diversion to electronic modes of "written" communication (EMS and EFT), by overall economic factors, and by competition from private message and parcel delivery systems. Taken together, it seems clear that two-thirds or more of the mailstream could be handled electronically, and that the volume of mail is likely to peak in the next 10 years and fall below today's level sometime in the 1990's.

EMS penetration of the mailstream will be paced by the introduction and widespread use of technologies such as high-quality electronic printers, office automation, home computer terminals, viewdata/teletext, and inexpensive home hardcopy terminals. EFT will be paced by the increased use of automated teller machines and point-of-sale terminals, and consolidation of bills and payments through telephone bill payer, debit cards, and direct deposit. In the long run, both EMS and EFT are likely to be possible over the same electronic terminals and communication networks. But in the shorter term, they are separate technologies. EMS itself has two distinguishable modes—Generation II EMS (electronic input and transmission with hard copy output) and Generation III EMS (all-electronic). This diversion of mail from conventional paper-based to electronic form is likely to stretch over many years and probably decades, depending on the rate of technological advance, on future postal rates, on regulatory constraints, and in part on intangible factors such as consumer acceptance and institutional marketing strategies.

OTA made several estimates of the rate of diversion of conventional mail to EMS and EFT. Mail diverted to Generation III EMS and EFT was assumed lost to the USPS mailstream. Because of the need to sort and deliver the hardcopy output from Generation II EMS, mail diverted to Generation II EMS was assumed to remain in the USPS mailstream. Mailgram and E-COM are Generation II services. In all of 1980, about 40 million Mailgrams were sent; in the first half-year of its existence (January through June 1982), about 660,000 E-COM messages were sent. During July 1982, E-COM averaged about 172,000 messages *weekly*. USPS also delivers an unknown, but small, number of letters that represent the hardcopy output of private sector Generation II EMS.

OTA did not independently estimate overall future economic growth or competition from private delivery services; representative past growth rates of the USPS mailstream were projected into the future. For example, the USPS mailstream has grown by about 2 percent per year if averaged over the 1900-77 period, and 3 percent over the 1947-77 period. In 3 of the last 4 years, the growth rate exceeded 3 percent. However, between 1971 and 1976, the growth rate was only about 1 percent.

If the recent 3 percent growth rate held for the next 20 years, USPS *conventional* mail would exceed the 1981 level (110 billion pieces) until the mid-1990's, even in the face of competition from high but plausible EMS and EFT growth. Assuming that USPS delivers the hardcopy output from Generation II EMS in that timeframe, USPS *total* deliveries would exceed the 1981 level until the turn of the century. Similarly, at 2-percent annual growth, and the same conditions, USPS *conventional* mail volume would exceed the 1981 level until about 1990, and *total* mail until the mid-1990's.

OTA conducted several sensitivity analyses to determine the conditions under which the

USPS mailstream might decline even faster. OTA concluded that the most likely condition would be continued economic recession or depression, which in the past (early 1970's and early 1930's) has resulted in a flat or even negative mailstream growth. This, coupled with even faster than anticipated introduction of all-electronic Generation III EMS and EFT, or escalation of USPS costs and rates above the level of alternative conventional and electronic delivery services, would accelerate the decline of the USPS mailstream.

Regardless of the underlying mailstream growth, the effect of Generation II EMS volume is to "cushion" or offset some of the decline in conventional mail, assuming USPS delivers the Generation II hardcopy output. Put differently, if Generation II volume reached significant levels, USPS-delivered mail volume (conventional plus Generation II) might be maintained at or above a given level for an additional 5 years or so.

For planning purposes, it is reasonable to assume that mail volume is likely to remain strong for most of the 1980's, and decline significantly in the 1990's. Under any plausible scenario, USPS is still likely to be handling a large volume (70 billion to 110 billion pieces) of mail in 2000.

Independent of the total USPS mailstream, the size of the potential Generation II EMS market itself takes on considerable importance with respect to decisions concerning USPS involvement. OTA has concluded that prior market estimates probably have been high. For example, RCA Corp. previously estimated a mature Generation II market (20 years hence) of 25 billion pieces. However, this exceeds even OTA's high but plausible Generation II projection by roughly 40 to 80 percent, depending on the underlying growth in demand for mail. It appears that RCA was overly optimistic about Generation II market development, ignored competition with Generation III EMS services, or both. OTA also identified a slow-growth Generation II path that projects a volume of about 40 million messages 5 years hence, increasing to about 600 million messages after 10 years and around 3 billion after 15 years. Given the highly volatile and unpredictable nature of the EMS market, it appears that prudent planning should be based on a maximum of one-half of the RCA-projected volume on down to the OTA-projected volume for Generation II slow growth. This would place the projected Generation II market 20 years hence in the range of 7 billion to 17 billion pieces rather than 25 billion.

There are legitimate differences of opinion as to how Generation II would fare after 2000, which was beyond the timeframe of the OTA study. Some analysts believe that Generation II would taper off very slowly and remain significant for many years. Others are convinced that Generation II might decline rather precipitously. However, it is likely that Generation III would surpass Generation II in absolute volume well before 2000. Indeed, unless Generation II grows at a high or very high rate, it is possible that Generation II would never exceed Generation III. Various private telecommunication carriers have indicated that most research and development (R&D) and marketing effort is going into Generation III, not Generation II.

## USPS Rates and Service Levels

USPS has some control over the way in which changes in mail volume might be reflected in rate and service level adjustments. While USPS is not allowed to make a profit overall, it need not "markup" all classes and subclasses of mail by the same amount over the costs specifically allocatable to each ("variable" costs). Thus, individual classes and subclasses make varying contributions to covering common ("fixed") costs. For example, first-class mail, with high volume and relatively high markup, historically has made the largest contribution to fixed costs of any class of mail. In fiscal year 1980, first-class mail made up about 57 percent of the total mailstream. Its contribution to USPS fixed costs was about $4.2 billion, based on an actual volume of 60 billion pieces (and assuming 20¢/piece revenue and 13¢/piece variable cost). This was about 55 percent of total fixed costs ($7.6 billion) in that year.

The example of first-class mail just cited is particularly relevant to this study because it is likely that most of the conventional mail diverted to EMS or EFT over the next 20 years will be first-class mail. Not only does it represent the largest volume of mail, but it is generally more amenable to electronic transmission than are other classes. Three-quarters of first-class mail is made up of correspondence, negotiable instruments (e.g., checks), and bills and financial statements.

If the first-class mailstream declined 10 billion pieces by the year 2000, and the 1980 cost and markup is assumed, first-class mail would contribute $700 million less to USPS fixed costs than it does today. Making up that loss by raising first-class rates alone would require a 7-percent increase. To the extent that USPS was delivering Generation II EMS hardcopy and making a profit on it, some or all of this rate increase could be avoided. This latter possibility is highly dependent on the cost of Generation II EMS (not well known) and the market price (also not well known).

Cost cutting would ease the necessity of increasing rates. This strategy would be particularly prudent if first-class rate increases would lead to a further volume reduction, which could set off a spiral of rate increases and volume reductions. Whether or not cutting costs would result in service cuts would depend in part on the USPS cost structure. Under the current cost structure (36 percent fixed costs, 64 percent variable), some service cuts would appear to be necessary. For example, USPS officials have estimated that delivery 5 days a week (instead of 6) would save about $650 million (1980 dollars). A 1976 USPS staff study projected a $1.1 billion (1977 dollars) savings for delivery 3 days a week.

In the longer term, USPS fixed costs may be reduced below the current 36 percent; other ways to improve productivity might be identified such that service levels could be maintained even at lower volumes and revenues. However, some significant portion of USPS costs clearly is required to pay for maintaining the basic nationwide delivery system and infrastructure, largely irrespective of the volume. For example, a substantial number of carriers are required to cover the approximately 69 million city USPS delivery points and 15 million rural delivery points (as of 1980) each day, 6 days a week, and to maintain window service at over 30,000 post offices, 9 hours or more a day, 5 or 5½ days a week. Likewise, some minimum level of truck transportation between post offices must be maintained to meet delivery performance standards, regardless of whether the trucks are carrying several dozen or several thousand letters. Labor currently accounts for about 85 percent of USPS costs and transportation about 7 percent (largely for trucks and other postal vehicles, plane and rail transportation). Thus, from this perspective, it is not clear that fixed costs could be reduced substantially without cutting service levels.

In sum, any projections of USPS revenues, costs, and rates are difficult at best, given:

1. the complexity of USPS revenue and cost relationships;
2. the fact that costs obviously vary by type of mail route (e.g., urban, suburban, rural), although USPS does not collect such cost data;
3. the problem of how to assign common costs properly to different mail services;
4. the uncertainty in determining what costs are variable with volume changes over various time periods; and
5. the uncertainty over future costs, rates, and volumes of Generation II EMS.

# Labor Requirements

USPS is a labor-intensive organization, with labor representing about 85 percent of total USPS costs. By making assumptions about the kind of service provided by USPS, the division of labor among its employees, and their productivity, it is possible to estimate the labor requirements for projected future mail volumes.

For the purposes of this labor force analysis, OTA assumed that the kind of service provided by USPS (service levels) would remain constant. That is, there would be no change in the number of delivery days (e.g., 6 days a week), post offices (over 30,000), weekday window service hours (typically 9 hours), or city and rural delivery points (over 84 million).

OTA calculated the division of labor among USPS employees by assuming that each functional group of employees would allocate their time in the future the same as they do now. That is, each employee group spends a certain fraction of its time in activities that are independent of the volume of mail ("fixed labor"); most groups also spend time in activities that do vary directly with the volume of mail ("variable labor").

OTA estimated variable and fixed percentages for each major group of USPS employees from the USPS fiscal year 1980 Revenue and Cost Analysis. The variable labor percentage is based on the variable attributable cost from the USPS analysis; the fixed labor percentage on the sum of specific fixed attributable costs plus all other institutional costs for each employee group. The variable and fixed labor percentages determined by OTA were reviewed with USPS and found to be reasonable.

The overall cost split for the entire USPS labor force was calculated to be 61 percent variable and 39 percent fixed. Individual employee groups varied from those independent of USPS mail volume to those almost completely dependent on it. As of 1980, 14,268 employees, or about 2.1 percent of the total USPS labor force, had no activities that varied with mail volume. Included would be headquarters, regional, and inspection service employees. On the other hand, almost all of the activities carried out by clerks and mail handlers varied with mail volume (86 percent variable/14 percent fixed). In fiscal year 1980, this group included 303,560 full- and part-time employees, or about 45 percent of the total 1980 USPS work force of 667,000 employees. The clerks and mail handlers would have limited participation in a Generation II EMS service, which would bypass many of the traditional mail sorting and processing functions performed by clerks and handlers. The hardcopy output of Generation II EMS would still require physical delivery by city or rural carriers.

Most other employee groups fall in between, having some activities that vary with total USPS-delivered mail volume (conventional plus Generation II EMS) and some that do not, but with a larger fixed component than clerks and handlers. These would include supervisory and technical personnel (48 percent fixed), city delivery carriers (50 percent fixed), maintenance personnel (about 55 percent fixed), and rural delivery carriers (73 percent fixed).

With respect to productivity, OTA assumed an average labor productivity improvement of 1.5 percent per year as a baseline. For comparison, USPS labor productivity is credited as increasing by roughly 3 percent annually during the 1970's, as measured by the number of pieces of mail per workyear. In fiscal year 1970, 741,000 postal employees delivered 85 billion pieces of mail, while in fiscal year 1980, 667,000 employees delivered about 106 billion pieces. The 3-percent figure may not reflect true labor productivity since service levels did change. For example, mailbox collection frequencies (per day) were generally reduced and cluster boxes were substituted for home delivery in many new suburban residential developments. Still, between 1971 and 1980 the number of city delivery points increased by about 21 percent and the number of rural delivery points increased by about 50 percent. Even assuming that the 3-percent annual average during the 1970's is an accurate measure, this does not appear to be a realistic expectation for the 1980's in view of the fact that most productivity improvement from automation and mechanization has already been realized. Even the expanded ZIP code program, known as ZIP + 4, would realize a total labor productivity improvement of only 2.3 percent, according to USPS estimates.

Taking these variables together, and assuming high but plausible EMS growth, OTA concluded that *the USPS labor force requirement in 2000 is most likely to be roughly 20 to 25 percent below the 1980 level.* This result is projected for the base case of 1.5-percent annual labor productivity improvement and 2-percent annual underlying mailstream growth, and also for the cases of 3-percent productivity improvement/3-percent mailstream growth, and 0-percent productivity improvement/1-percent mailstream growth. Under all three of these scenarios, the need for significant labor force reductions is not likely to be felt until the late 1980's and early 1990's, but would increase quite rapidly thereafter.

Whatever the level of reductions, they are not likely to be spread evenly among all employee groups. The post office clerks and mail handlers group would be expected to be hit the hardest, losing perhaps two-fifths of their 1980 complement by 2000. Post office supervisors and city delivery carriers could, by 2000, be reduced by about one-fifth and rural delivery carriers by about one-tenth of their 1980 complements.

Whether or not these labor force reductions could be handled through attrition depends largely on future USPS retirement, quitting, and new hire rates. But the uneven impact of reductions on various employee groups makes this unlikely. In addition, the uneven distribution of minority employment among employee groups raises the possibility that such reductions may fall disproportionately on black and perhaps other minority employment. For example, as of late 1978, the mail handlers, whose employment would be reduced the most, had one of the highest percentages of black employment. Involuntary labor force reductions in this area, if needed, would likely raise some difficult social and political issues.

Overall, the impact of labor force reductions on promotion opportunities, upward mobility, employee morale, and union contract negotiations could be significant. These areas warrant further study.

## Policy Implications

The OTA analysis indicates that, regardless of what role USPS plays in Generation II electronic mail, reductions in USPS-delivered mail volume due to diversion to Generation III EMS and EFT could reach significant levels by 2000. The threat to USPS-delivered mail could come even sooner if Generation III EMS services (all-electronic) develop faster than currently anticipated, if the underlying growth in the mailstream is less than the historical average, or if diversion of second- and third-class mail to alternative (nonelectronic) delivery services increases significantly beyond current levels.

Although a USPS role in Generation II EMS has the potential to provide a volume and revenue "cushion" to partially offset reductions in conventional mail volume and revenue, there is little consensus among USPS and major stakeholders on exactly what the USPS role should be in the provision of Generation II EMS.

The market penetration results indicate that USPS-delivered mail volume (conventional mail plus Generation II EMS hardcopy output) is one key factor in considering a USPS role in Generation II EMS. USPS-delivered volume is a function in part of the rate of

Generation II EMS growth. Assuming that USPS delivers Generation II EMS hardcopy output, the faster the rate of growth (and the earlier the takeoff), the larger the Generation II EMS volume and USPS-delivered volume. There is currently little agreement on which USPS role would contribute the most to Generation II EMS growth and volume.

The revenue/cost results indicate that Generation II EMS cost displacement and contribution to covering USPS fixed costs are also key factors in considering a USPS role. The greater the cost displacement (avoidance of conventional mailstream costs) and contribution to covering USPS overhead, the less likely the need for service (and/or labor) reductions. Mailgram apparently provides both a substantial cost displacement and contribution to fixed costs; it is not clear whether E-COM would do likewise at current rates and in its present configuration. All parties, including USPS, agree that the RCA cost estimates prepared for the Electronic Message Service System in 1977 and the original E-COM cost estimates prepared for the Postal Rate Commission in 1978 are now outdated. If E-COM is to be fully evaluated and its role in USPS' future understood, a comprehensive cost review of E-COM is needed.

In contrast, there is general agreement that USPS participation in Generation II EMS would generate only a relatively small number of new jobs. An estimated 200 persons (125 operations, 50 maintenance, 25 marketing and administrative) currently work on E-COM. A fully deployed service (at 150 serving post offices (SPOs) rather than the current 25) is estimated to require perhaps 2,000 persons. The additional volume from USPS delivery of Generation II EMS hardcopy output could help to offset some of the reductions in the existing labor force that will be necessary if the projected decline in USPS-delivered mail materializes.

Based on interviews with many of the stakeholders and a comprehensive review of the historical record, OTA has concluded that absent congressional action, the controversy over the USPS role in EMS is likely to continue indefinitely. The fairness and legality of a USPS role in EMS, the impact on innovation and competition in the EMS industry, and implications for EMS privacy and security continue to be in dispute. Although the U.S. District Court of Appeals has denied a Department of Justice petition to block E-COM, further regulatory proceedings are anticipated and additional legal actions are possible.

With continuing uncertainty over the future of E-COM, and in general over the USPS role in EMS, the prospects for a successful USPS entry into domestic EMS services are uncertain. This affects both USPS and its potential competitors in the private sector. Some firms have indicated to OTA that they are reluctant to make any major commitments until they are certain what role USPS is going to have. Meanwhile, most private sector R&D efforts are going into Generation III EMS, which would completely bypass USPS. In addition, given the continuing adversarial atmosphere, USPS is unable to establish effective working relationships with many private carriers and potential Generation II EMS users.

Should Congress wish to take action, there are several possibilities: 1) provide a clear direction for USPS involvement in EMS; 2) reduce or eliminate further regulatory and judicial delay; 3) strengthen privacy and security protection; and 4) maintain oversight and initiate planning on USPS long-term viability. These possibilities are outlined below.

## Provide a Clear Direction for USPS Involvement in EMS

There is a range of alternatives for a USPS role in EMS:

1. no real involvement other than delivery of Generation II EMS hardcopy output when deposited into the mailstream;
2. delivery of all hardcopy output when conveyed over postal roads;
3. hardcopy delivery plus location of carrier-provided EMS terminal equipment on USPS premises (as in Mailgram);

4. the current E-COM role or variations of it (e.g., the use of logo envelopes to retain carrier and mailer identities);
5. involvement in the telecommunication portion of EMS as well as printing, enveloping, and delivery; and
6. involvement in Generation III EMS as well (e.g., through lease or contract with private industry).

Each of these alternatives is technically feasible. In evaluating each, Congress may wish to take into account some or all of the following broad considerations:

- the extent to which each alternative would contribute to Generation II EMS growth and volume;
- the extent to which each alternative would favorably affect USPS finances, i.e., EMS cost displacement and contribution to covering USPS fixed costs;
- the extent to which each alternative, through creating new jobs and increasing USPS mail volumes, would defer or partially offset labor reductions that might otherwise be necessary;
- the extent to which each alternative would provide incentives for marketing by USPS and/or private firms;
- whether changes in the Postal Reorganization Act are needed to permit more flexibility in the USPS decisionmaking process (including regulatory review) with respect to USPS involvement in EMS;
- whether the term "demonstrated need" for USPS to contract with a telecommunication carrier to transmit messages electronically on behalf of USPS needs to be clarified; and
- whether or not there are any conditions that would constitute demonstrated need for USPS involvement in electronic delivery (presumably by contract with private Generation III EMS firms); for example, in geographic areas where conventional mail service could no longer be maintained at present levels.

With regard to E-COM itself, Congress may wish to review the following specific issues:

- whether or not space should be provided in SPOs for carrier output equipment;
- whether or not the technology selected by RCA for E-COM is the best available;
- whether technical modifications to the current E-COM interconnection arrangement could permit more total lines (and at what cost) for carrier and user access, and whether alternative access allocation schemes should be considered; and
- whether E-COM performance standards and design should be modified to guarantee 1-day delivery.

## Reduce or Eliminate Further Regulatory and Judicial Delay

The most important action Congress can take to reduce delay is to provide clear direction for USPS involvement in EMS. A note of caution is in order. If the direction set out is not well understood and does not reflect a substantial consensus, further regulatory disputes and litigation could result.

Additionally, Congress could:

- clarify the applicability of the Private Express Statutes to delivery of Generation II EMS hardcopy output;
- delineate the division of regulatory jurisdiction between the Postal Rate Commission and the Federal Communications Commission; and
- decide on the desirability of a separate USPS entity for any EMS offering.

## Strengthen Privacy and Security Protection

Privacy protection in a USPS EMS service is a continuing issue. Preliminary discussions with USPS indicate that while the E-COM equipment is apparently physically secure, the potential for security breaches does exist. User account numbers are visible on the outside of E-COM envelopes. When combined with an access code and familiarization with the E-COM technical interconnection standards, this information would permit unauthorized use of

E-COM. Incoming messages are stored for 1 week in computer memory or on magnetic tape, providing another target for security violations. These archived messages could also be tapped via the management information system, since the E-COM computers in the 25 centers are connected electronically with this system.

Congress may wish to consider: 1) whether an independent review of E-COM security is warranted to ensure that adequate security measures are in place to protect the privacy of EMS messages, and 2) whether the Postal Act and/or Communications Act should be amended to provide additional statutory privacy protection (including the possible mandating of data encryption to provide additional technical privacy protection).

## Maintain Oversight and Initiate Planning on USPS Long-Term Viability

Although the immediate focus is on E-COM, and on providing a clear direction for USPS involvement in EMS and resolving current regulatory problems and delays, EMS issues are likely to be with Congress for many years, driven by the impact of EMS on USPS, the role of USPS in EMS, and the broader impact of EMS on American society and the public at large. For a discussion of these broader impact areas, see the related OTA report on *Computer-Based National Information Systems* (1981). Within this context, Congress will need to maintain oversight and initiate planning on USPS long-term viability.

The following areas warrant further study:

- USPS initiatives designed to develop improved working relationships with private telecommunication and computer firms;
- joint technical and market tests with private firms to evaluate various EMS alternatives;
- use of EMS to help USPS maintain adequate service levels to rural and less populated areas;
- use of EMS to help USPS offset the reduction (or elimination) of the revenue forgone subsidy (which is provided to offset revenue losses from mail service provided at reduced rates) and permit continuation of a lower rate to nonprofit and educational organizations;
- use of EMS in the future in combination with the USPS infrastructure (perhaps scaled down) and delivery network to provide other Federal Government services (e.g, printing and delivery of forms and documents); and
- USPS long-range planning on the possible need for labor force reductions, job retraining, adjustments in retirement and new hire rates, and implications for union contract negotiations.

In view of aggressive private sector Generation III EMS activity and the continuing economic trends that work in favor of electronic mail and against paper-based mail, it seems clear that Congress and USPS should begin planning now for the future viability of USPS. Changes are taking place so fast in the so-called "communications revolution" that by the time USPS might actually experience significant impacts on mail volume, most opportunities for participation in EMS will have passed and it will be much more difficult to adjust.

## Chapter 2

# Background and Purpose of Study

# Contents

Page
Introduction . . . . . . . . . . 15
Congressional Interest . . . . . . . . . . 17
Study Purpose and Approach . . . . . . . . . . 18

## Chapter 2

# Background and Purpose of Study

## Introduction

By some measures, the U.S. Postal Service (USPS) has done remarkably well in the 10 years since postal reorganization.* Gross productivity, as measured by number of pieces of mail per workyear, has increased by 34 percent since fiscal year 1970 when 741,000 postal employees delivered 85 billion pieces of mail. In fiscal year 1980, 667,000 employees delivered 106.3 billion pieces of mail. In 1980, mail volume increased by 6.5 percent over 1979. First- and third-class mail volumes continue to show strength with increases of approximately 15 and 36 percent, respectively, over the last 5 years. During the same period, pieces of mail per capita have increased by about 13 percent, from 418 pieces per person in fiscal year 1976 to 480 pieces in 1980.[1]

On the financial side, USPS more than broke even over the combined 1979-80 period. The surplus of $470 million in fiscal year 1979 offset a deficit of $306 million in 1980. The cost of postage continues to rise, but since 1975 at a rate that is lower than the consumer price index. If fully adjusted for inflation since 1975, a first-class stamp would cost 22¢ rather than the current 20¢. However, if fully adjusted for inflation since 1967, a first-class stamp would cost only about 14¢. Thus, about 6¢ out of the current 20¢ represents a real increase in the first-class letter rate since 1967. The letter rate in the United States continues to be well below rates in most other countries. For example, in 1980 the letter rate was about 29¢ in Britain and Japan, 31¢ in France and Sweden, and 33¢ in West Germany.[2]

Why, then, is there concern about the future of USPS? While recent years have been relatively good, the 1980's and 1990's will pose a number of new and perhaps more difficult challenges.

First, *the potential for further improvements in postal productivity through presort discounts and through mechanization and automation is limited.* Even a fully implemented expansion of the ZIP code to nine digits (known as ZIP + 4) would mean a cumulative reduction of only about 15,600 workyears by 1987 according to USPS estimates. Compared to the current USPS annual workyears of 679,000, the productivity improvement would amount to about 2.3 percent.[3] This means that continued automation will provide only a small part of the total productivity improvement needed by USPS to offset inflationary increases in employee compensation and transportation, which together account for over 92 percent of total USPS annual expenditures.[4]

Second, while USPS operating statistics indicate that ontime delivery has been maintained for 95 percent of first-class mail destined for local or metropolitan area overnight delivery, *ontime delivery within 600 miles and for cross-country first-class mail generally has declined since 1977.* Two-day delivery of letters within 600 miles was achieved 86 percent of the time in 1980 compared to 90 percent in 1977. Three-day delivery of cross-country letters was achieved 87 percent of the time in 1980 compared to 91 percent in 1977.[5] Part of the problem can be attributed to cutbacks in air carrier service, but it is also possible that the rising total volume of mail has begun to tax the capacity of the overall mail distribution system. For example, postal officials have testified that the elimination of Saturday delivery alone would create a mail backlog sufficient to overload the system for Monday delivery. On the other hand, postal officials point to the system's ability to handle peak volumes during holiday periods as evidence that overall capacity has not been reached.

---

*The Postal Reorganization Act of 1970 enacted by Congress abolished the Post Office Department as a cabinet level agency of the executive branch. Postal functions were transferred to an independent Government agency known as the United States Postal Service, which commenced operations on July 1, 1971.

[1] *Annual Report of the Postmaster General,* fiscal 1980.

[2] Ibid.

[3] Comptroller General of the United States, *Implications of Electronic Mail for the Postal Service Work Force* (Washington, D.C.: U.S. General Accounting Office, Feb. 6, 1981), p. 32. The estimated changes in workyears per year from the nine-digit ZIP are as follows: 1981 (+3), 1982 (+87), 1983 (−1334), 1984 (−2382), 1985 (−3301), 1986 (−4378), and 1987 (−4295) for a total reduction of 15,600 workyears. Per Nov. 4, 1981, discussion with Douglas Lynn of the USPS Operations Group.

[4] *Annual Report,* op. cit., p. 24.

[5] Ibid., pp. 8, 11.

Third, *a variety of technical, regulatory, and market developments are contributing to a rapid increase in commercially offered electronic mail and message systems (EMS) that increasingly will compete with USPS.* As early as 1977, studies projected that EMS could divert substantial portions of mail from USPS, to the extent that total mail volume might actually start to decline by the early 1980's.[6] None of these projections has yet been realized. However, the large number of commercial firms now in the electronic message market,* coupled with recent developments in personal computers, viewdata/teletext, and other home information systems, suggests that this prospect is much more realistic than it was just a few years ago. Furthermore, regulatory decisions by the Federal Communications Commission over the last few years, coupled with congressional actions to rewrite the Communications Act of 1934, are clearing the way for increased competition in the electronic message market. Thus, while EMS will undoubtedly stimulate new message "traffic" between individuals and organizations, they also have the potential for diverting existing traffic from other media, including a portion of the message traffic currently handled by the U.S. Mail. This diversion would come at a time when mail volume may also be reduced by the consolidation of many bills and payments, or the elimination of some billing and payment transactions altogether, as a consequence of the implementation of electronic funds transfer (EFT) systems.

Substantial erosion of U.S. Mail volumes, particularly first-class mail, could tend to raise the unit cost of carrying the remaining mail volume and/or force a reduction in the quality and convenience of mail service, thus providing further incentive for mail users to switch to alternatives such as private delivery services, newspaper inserts, and the like. Such a development could disadvantage users without a viable alternative to the U.S. Mail, jeopardize the ability of USPS to provide universal service, and adversely affect USPS employees.

An important issue for USPS is whether and how it will participate in the provision of electronic mail and message services. USPS currently provides a portion of Western Union's Mailgram service, and in January 1982 introduced a domestic service called "electronic computer-originated mail" (E-COM). An international EMS service, known as "international electronic post," has also been initiated. INTELPOST is outside the scope of this study. USPS has been developing a more advanced "electronic message service system" or EMSS which, for the purposes of this study, is considered to be an extension of E-COM to full nationwide deployment at all or most serving post offices. There are a variety of ways in which USPS could play one or more roles in the provision of EMS services, ranging from the delivery of hardcopy output to the provision of a complete end-to-end electronic mail service.

The Annual Report of the Postmaster General for fiscal year 1979 states flatly: "In the future, the only way the Postal Service will be able to keep its volume rising and finances dependable is through participating in electronic mail services."[7] In a July 1979 policy statement, the White House agreed, stating that "the national interest requires a Postal Service which can serve all Americans and interface with the world's postal services efficiently and economically. The service has progressively achieved productivity improvement by mechanization and automation in processing of conventional mail . . . A postal EMS is the next logical step to achieve further cost reduction and mail processing improvement."[8]

---

[6] See, for example, F. B. Wood, R. W. Anthony, et al., *USPS and the Communications Revolution: Impacts, Options, and Issues*, Final Report to the Commission on Postal Service, prepared by the Program of Policy Studies in Science and Technology, The George Washington University, Washington, D.C., Mar. 5, 1977. Also see Arthur D. Little, *The Impact of Electronic Communication Systems on First Class Mail Volume in 1980-1990*, Cambridge, Mass., April 1978.

*Examples include Quik-Comm (General Electric), Telemail (GTE Telenet), On-Tyme (Tymnet), InfoPlex (Plexus), Faxgram (Graphnet), Mailgram (Western Union), and Datapost (Southern Pacific). Electronic mail is also one of several services offered by Satellite Business Systems and other specialized or value-added common carriers.

Over the last 3 years, the role of USPS in EMS has been in dispute before various regulatory agencies, the courts, and Congress. USPS initiated E-COM service in January 1982 after the USPS Board of Governors approved the Postal Rate Commission's (PRC) 1980 recommended decision, with the exception of PRC's "experimental" designation (of E-COM as an experimental rather than a permanent service) which was successfully appealed by the Governors to the courts. However, several private firms and the current administration believe that E-COM as presently implemented differs significantly in other ways from the concept originally recommended by PRC. A 1981 inquiry opened by PRC to review what form of E-COM USPS should be offering was suspended after its legality was challenged by USPS.

Comments filed before PRC jointly by the Departments of Commerce and Justice and a court challenge to E-COM filed by Justice indicate that the current administration is not supportive of E-COM as presently operating, or possibly of any USPS role in EMS that involves telecommunication, data processing, or printing. This in part reflects continuing concern that E-COM places an independent Government agency (USPS) in competition—perhaps unfairly and/or illegally—with private firms. Some of these firms believe that the demand for EMS can be met by private offerings, and that the USPS role should be restricted to the delivery of hardcopy output from electronic message systems. Others are concerned that in the future USPS may expand its EMS role from printing, enveloping, and physical delivery—as in E-COM—to include telecommunication and perhaps electronic delivery as well.

## Congressional Interest

The implications of electronic mail and message systems for USPS, and especially the role of USPS in EMS, have been and continue to be a primary concern of congressional committees with direct jurisdiction over USPS and the Postal Reorganization Act of 1970, i.e., the House Committee on Post Office and Civil Service (and particularly the Subcommittee on Postal Operations and Services and the Subcommittee on Postal Personnel and Modernization) and the Senate Committee on Governmental Affairs (especially the Subcommittee on Civil Service, Post Office, and General Services).

The role of USPS is also of interest to the committees with jurisdiction over telecommunications to the extent that USPS becomes involved with an EMS service that is subject to the Communications Act of 1934, in whole or in part. These committees include the House Committee on Energy and Commerce (and the Subcommittee on Telecommunications) and the Senate Committee on Commerce, Science, and Transportation (Subcommittee on Communications). In addition, other committees, such as the House Committee on Government Operations Subcommittee on Government Information and Individual Rights, have an interest in the privacy, competitive, and related implications of a USPS role in EMS.

Despite a variety of legislative initiatives in recent years, Congress has yet to agree on a clearly defined EMS role for USPS. H.R. 2813, introduced in the 97th Congress, would require

---

[7] *Annual Report of the Postmaster General*, fiscal 1979, p. 6.

[8] Administration Policy Statement, The White House, July 19, 1979.

USPS to establish a separate organizational unit to provide EMS service, would prohibit cross-subsidization of EMS from public funds, would prohibit USPS from owning telecommunication services (but would permit USPS to contract for same), and would limit USPS to EMS services where the output is physically delivered through the U.S. Mail.[9] H.R. 4758, also introduced in the 97th Congress, would prohibit all Federal agencies, including USPS, from providing data-processing or telecommunication services to non-Federal persons or entities unless explicitly authorized by statute. This bill would appear to prohibit USPS from offering telecommunication transmission and data-processing services without specific congressional approval.[10] In the Senate, S. 898, "The Telecommunications Deregulation and Competition Act of 1981," as enacted includes an amendment intended to clarify provisions of the act relating to electronic mail. The amendment makes clear that S. 898 does not authorize or prohibit USPS from offering telecommunication services or the electronic delivery of messages, whether by resale or otherwise. If, at some future time, Congress should authorize USPS to offer such service or if current law is interpreted to authorize it, the amendment stipulates the conditions under which such service would be offered, including the establishment of a separate organizational entity, among other things. Thus, in effect, S. 898 and the related Senate floor debate prior to enactment reaffirm the absence of congressional consensus on the participation of USPS in EMS.[11]

## Study Purpose and Approach

This study addresses three major questions:

1. To what extent are privately offered EMS and EFT systems likely to affect the volume of mail handled by USPS?
2. Are changes in USPS mail volume likely to lead to significant adjustments in USPS rates, service levels, and/or labor force requirements? and
3. What are the implications for the future of USPS and how it might participate in the provision of EMS services?

At the heart of the study are two computer-based quantitative models. The first is a market penetration model used to project the level of conventional and electronic mail volumes under different sets of assumptions, and the second is the USPS revenue and cost model. There are four basic inputs to the market penetration model: 1) the baseline description of the mail flows derived from a survey based on 1977 data conducted for USPS by the Survey Research Center at the University of Michigan;[12] 2) a set of EMS and EFT technology assumptions; 3) a set of assumptions about the underlying growth rate of the mailstream; and 4) the range of selected alternatives (e.g., low, medium, high growth) for EMS development. The market penetration model is explained in chapter 3 and appendixes A and B, and the results are outlined in chapter 4.

The second quantitative model is the USPS revenue and cost model. It is designed to project the impacts of the growth or decline of overall USPS mail volume (conventional and EMS) on USPS rates, service levels, and labor requirements. The USPS revenue and cost model and the results for first-class mail are presented in chapter 5.

---

[9] H.R. 2813, 97th Cong., 1st sess., Mar. 25, 1981, to amend title 39 of the United States Code, referred to the Committee on Post Office and Civil Service.

[10] H.R. 4758, 97th Cong., 1st sess., Oct. 15, 1981, to amend the Federal Property and Administrative Services Act of 1949. See *Congressional Record—House*, Oct. 15, 1981, p. H7425.

[11] See *Congressional Record—Senate*, Oct. 7, 1981, pp. S.11211-11216.

[12] M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report*, prepared for Mail Classification Research Division, U.S. Postal Service, 1978.

This study gives primary emphasis to impacts on the USPS mailstream (based on results of the market penetration model) and on USPS rates, service, and labor (based on combined results of the market penetration model and the revenue and cost model). Implications for rates, service, and labor are summarized in chapter 6. Secondary emphasis was placed on the potential implications for the telecommunication and computer industries, EMS privacy and security, and the long-term viability of USPS, discussed in chapter 7. Congressional policy considerations are discussed in chapter 8.

A note on computer modeling is in order. Prior studies on mail diversion have proven to be oversimplified. In order to better understand the complexities involved, OTA developed and used computer-based models to permit consideration of a larger number of variables and interrelationships than would otherwise be possible. While this approach is more systematic and complete than those used in prior studies, computer modeling has its limitations.

First, the precision of the projections can be misleading. The reader should focus on general trends and relationships rather than the specific numbers projected. Second, the models are highly sensitive to initial assumptions. For this reason, sensitivity runs were conducted to see how much projections would change with different assumptions. Third, the models have limited ability to anticipate unexpected events. For example, the possibilities of a World War III, second Great Depression, mandatory wage/price freeze, nationwide postal labor strike, or repeal of the Private Express Statutes were not included. In other words, the models are based on a relatively "surprise-free" future. Fourth, the models do not fully reflect the possible effect of rates on mail volumes. There is a feedback process, but its exact nature is unknown. That is, changes in rates may have a significant effect on mail volume, which in turn affects mail rates 1, 2, or 3 years later (in the next ratesetting cycle). Despite these limitations, computer modeling can be a useful analytical tool.

Again, the study as a whole, and particularly the use of computer modeling, is intended to help Congress better understand the possible implications of EMS for USPS. The study is not intended to make a prediction of the future course of events. Many variations are possible. Finally, the study specifically avoids making judgments about the impacts identified and makes no recommendations relative to the role of USPS.

## Chapter 3

# Market Penetration Model and Technology Assumptions

# Contents

Page
Introduction . . . . . . . . . . 23

Baseline Mailstream . . . . . . . . . . 24

EFT Diversion . . . . . . . . . . 26

EMS Diversion . . . . . . . . . . 27
  Generation II Growth and Timing Estimates . . . . . . . . . . 29
  Generation III Growth and Timing Estimates . . . . . . . . . . 30
  Relationships Between Generation II and Generation III Estimates . . . 31
  Alternative Generation II Growth and Timing Estimates . . . . . . . . . . 32

Underlying Mailstream Growth . . . . . . . . . . 33

## TABLES

*Table No.* *Page*
1. Baseline Mailstream . . . . . . . . . . 24
2. Mail Content . . . . . . . . . . 24
3. Major Mailstream Segments Vulnerable to Penetration by Electronic Funds Transfer . . . . . . . . . . 25
4. Major Mailstream Segments Vulnerable to Penetration by Electronic Mail and Message Systems . . . . . . . . . . 25
5. Assumptions About Rate of EFT Penetration . . . . . . . . . . 26
6. Assumptions About Rate of EMS Penetration . . . . . . . . . . 29
7. Assumptions for Generation II Growth Alternatives . . . . . . . . . . 32
8. Alternative Assumptions About Underlying Mailstream Growth Rate . . . . . . . . . . 33

## FIGURES

*Figure No.* *Page*
1. Market Penetration Model . . . . . . . . . . 23
2. Comparison of Conventional Mail Service With Generations I, II, and III EMS Service . . . . . . . . . . 28

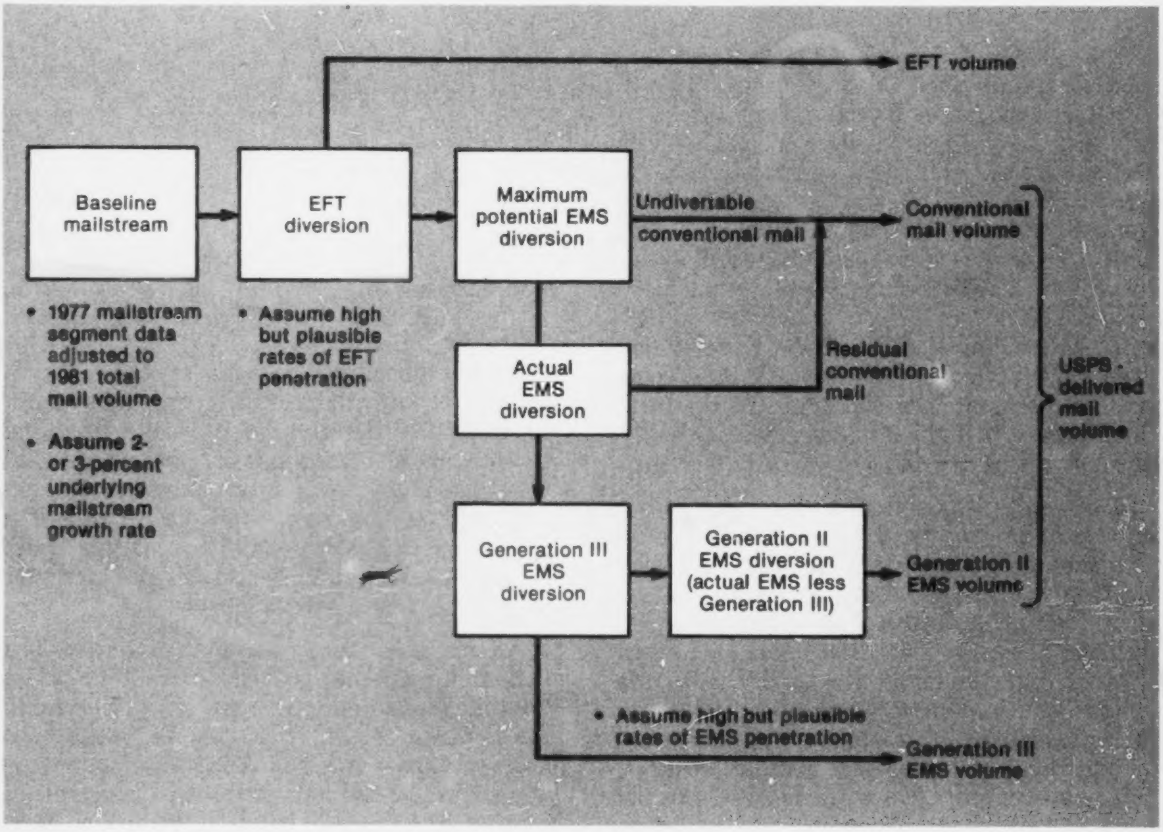
## Chapter 3

# Market Penetration Model and Technology Assumptions

## Introduction

The primary purpose of the market penetration model is to estimate the level of electronic and conventional mail volumes in 1985, 1990, 1995, and 2000. The basic elements of the model are shown in figure 1. (See app. A, fig. A-1, for further details.)

Figure 1.—Market Penetration Model


EFT volume
Baseline mailstream
EFT diversion
Maximum potential EMS diversion
Undivertable conventional mail
Conventional mail volume
• 1977 mailstream segment data adjusted to 1981 total mail volume
• Assume 2- or 3-percent underlying mailstream growth rate
• Assume high but plausible rates of EFT penetration
Actual EMS diversion
Residual conventional mail
USPS - delivered mail volume
Generation III EMS diversion
Generation II EMS diversion (actual EMS less Generation III)
Generation II EMS volume
• Assume high but plausible rates of EMS penetration
Generation III EMS volume

SOURCE: Office of Technology Assessment, see app. A, table A-1 for further details.

# Baseline Mailstream

As one input to the market penetration model, the baseline mailstream was divided into a number of different submarkets (subclasses of mail) in two ways—by mail content and by sender/receiver pairs. The mail content categories included correspondence, merchandise, bills, financial statements, and advertising, among others. Senders and receivers were grouped into households and nonhouseholds. Thus, the four possible sender/receiver pairs included household-to-household, household/nonhousehold, nonhousehold/household, and nonhousehold/nonhousehold.

The baseline volume for every class of conventional mail (first, second, third, fourth, other) was estimated for each category of mail content and sender/receiver pair. These estimates were based on data in two studies conducted for the U.S. Postal Service (USPS) by the University of Michigan Survey Research Center known as the *Household Mailstream Study* and *Nonhousehold Mailstream Study,* which in turn were based respectively on 1977 and 1979 mailstream data.[1] For consistency, the 1979 nonhousehold data were used to establish ratios among the types of mail and then applied to 1977 mail volumes so that all data would be for the 1977 calendar year.

The resulting baseline mailstream is highlighted in tables 1 and 2 and detailed in appendix A (table A-1). It is possible that some shifting among the mail segments has occurred since 1977, although a comparison of data for the 1977 and 1980 fiscal years indicates no major changes. The total mail volume has grown from about 92 billion to 106 billion pieces between 1977 and 1980. First-class mail has decreased from 58 percent of the total to 56.6 percent; second-class mail has decreased from 9.4 percent to 7.9 percent; and third-class mail has increased from 26 percent to 28.5 percent of the total mail volume.[2]

**Table 1.—Baseline Mailstream**

| | To households | To nonhouseholds |
|---|---|---|
| From households | 7.6% (7.1 billion pieces) | 9.9% (9.2 billion pieces) |
| From nonhouseholds | 53.3% (49.7 billion pieces) | 29.2% (27.3 billion pieces) |

SOURCE: 1977 data, University of Michigan Mailstream Study conducted for USPS, percentages shown are based on total 1977 mail volume of 93.3 billion pieces. See app. A, table A-2, for further details.

**Table 2.—Mail Content (illustrative)**

| | To households | To nonhouseholds |
|---|---|---|
| From households | Correspondence—7.1 percent of total mail volume | Negotiable Instruments (e.g., checks)—7.0 percent<br>Correspondence—1.5 percent |
| From nonhouseholds | Third-class (mostly bulk rate) mail—10.2 percent<br>Bills—9.5 percent<br>Advertising—9.1 percent<br>Financial statements—2.8 percent | Bills and financial statements—9.1 percent<br>Correspondence—6.1 percent<br>Advertising—5.7 percent |

SOURCE: University of Michigan Mailstream Study conducted for USPS. Percentages shown are based on total 1977 mail volume. See app. A, table A-2, for further details.

Mail originating from nonhouseholds constitutes over four-fifths of the total mailstream. Nonhousehold-originated bills and financial statements alone account for over one-fifth of the total, advertising about one-seventh, and bulk rate mail over one-tenth. Of the one-fifth of the mail originating from households, most is either correspondence (letters and cards) or negotiable instruments (checks).

All mailstream segments were evaluated to determine whether they potentially could be handled (in whole or in part) by electronic funds transfer (EFT) and/or electronic mail and message systems (EMS). Those major segments judged to be vulnerable to penetration by EFT and/or EMS are listed in tables 3 and 4. (See app. A, table A-2, for a complete list.)

As shown in tables 3 and 4, accounting only for major mailstream segments, about two-thirds of the mailstream is vulnerable to penetration by EFT and/or EMS. This translates into about three-quarters of first-class mail

---

[1] M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report,* prepared for the Mail Classification Division, USPS, 1978. Also, *Nonhousehold Mailstream Study, Interim Report for First Postal Quarter PFY 1979,* July 1979.

[2] *Annual Report of the Postmaster General,* fiscal 1980, pp. 28-29.

**Table 3.—Major Mailstream Segments Vulnerable to Penetration by Electronic Funds Transfer**

| Mailstream segment | Mail class | 1977 volume (billions of pieces) | Percentage of first-class mail | Percentage of total mail |
|---|---|---|---|---|
| Nonhousehold to household bills | 1 | 8.9 | 15.4% | 9.5% |
| Nonhousehold to household financial statements | 1 | 2.6 | 4.5 | 2.8 |
| Nonhousehold to nonhousehold bills and financial statements | 1 | 8.4 | 14.6 | 9.0 |
| Household to nonhousehold negotiable instruments | 1 | 6.5 | 11.3 | 7.0 |
| Totals | | 26.4 | 45.8% | 28.3% |

SOURCE: University of Michigan Mailstream Study conducted for USPS. Percentages based on total 1977 mail volume of 93.3 billion pieces and 1977 first-class mail volume of 57.7 billion pieces. First-class mail defined to include penalty and franked mail.

**Table 4.—Major Mailstream Segments Vulnerable to Penetration by Electronic Mail and Message Systems**

| Mailstream segment | Mail class | 1977 volume (billions of pieces) | Percentage of mail class | | |
|---|---|---|---|---|---|
| | | | First | Third | Total |
| Household to household correspondence | 1 | 6.6 | 11.4% | — | 7.1% |
| Household to nonhousehold correspondence | 1 | 1.4 | 2.4 | — | 1.5 |
| Nonhousehold to household third-class (mostly bulk rate) mail | 3 | 9.5 | — | 38.8% | 10.2 |
| Nonhousehold to household advertising | 1 | 1.1 | 1.9 | — | 1.2 |
| | 3 | 7.2 | — | 29.4 | 7.7 |
| Nonhousehold to nonhousehold advertising | 1 | 2.3 | 4.0 | — | 2.5 |
| | 3 | 3.0 | — | 12.3 | 3.2 |
| Nonhousehold to nonhousehold correspondence | 1 | 5.2 | 9.0 | — | 5.6 |
| Totals | | 36.3 | 28.7% | 80.5% | 39.0% |

SOURCE: University of Michigan Mailstream Study conducted for USPS. Percentages based on total 1977 mail volume of 93.3 billion pieces and 1977 first-class mail volume of 57.7 billion pieces, and 1977 third-class mail volume of 24.5 billion pieces. First-class mail defined to include penalty and franked mail.

volume and about four-fifths of third-class mail. Actually, only the merchandise and miscellaneous segments and nonhousehold to nonhousehold legal/financial instruments were assumed to have no vulnerability. Legal/financial instruments were assumed to have no potential for electronic handling due to the frequent requirement for verified and original signatures, endorsements, and documentation for many such instruments. Even here, the possibilities for electronic certified mail and electronic contract signing are being researched.[3]

---

[3] "Cryptographers Gather to Discuss Research," *Science*, vol. 214, Nov. 6, 1981, p. 647.

# EFT Diversion

The next step in the market penetration model was to subtract from the baseline mailstream the mail that could be diverted to EFT. While for some purposes EFT might be viewed as a special type of EMS, other EFT applications, such as the point-of-sale use of debit cards, could eliminate certain payment messages altogether. Accordingly, in this study EFT was considered to be separate from EMS. Mail diverted to EFT was considered unavailable for EMS. For mailstream segments such as bills and statements where both EFT and EMS could produce diversion, EFT diversion was assumed to occur first. The residual mail volume in each mail segment after EFT diversion was then considered the potential market for EMS diversion. The diversion to EFT was modeled using the logistic substitution process described in appendix B.

**Table 5.—Assumptions About Rate of EFT Penetration**

Year of 5 percent penetration—1985
Year of 75 percent penetration—2005
Initial exponential growth rate (1985)—20 percent
Growth rate at 50 percent penetration (year 2000)—5 percent
Penetration potential—0.9 for bills and financial statements
1.0 for negotiable instruments

***Key technologies***

Automated teller machines (ATMs)
  25,000 in operation (1981)
  ATMs estimated by industry to at least double by 1990 and could increase to 120,000 (an annual growth rate of roughly 10 to 20 percent):
  - deposit
  - cash withdrawal
  - bill or loan payment
  - cash advance

Point-of-sale terminals
  87,500 in service (1981):
  - check validation
  - credit card authorization
  - debit of transaction balance

Telephone bill payment (TBP)
  302 financial institutions offer (1980)
  TBP transactions estimated by industry to be growing by 27 percent a year:
  - bill or loan payment
  - account status inquiry
  - interaccount transfer

SOURCE: Office of Technology Assessment; see app. A, table A-3, for further details.

Based on the results of a separate OTA study,[4] current trends suggest that a significant consolidation of bills and financial statements is likely to take place via EFT, but that it will take many years. OTA has assumed that the use of EFT for bills and financial statements in the long run would result in a 90-percent reduction in total bills and statements received via conventional mail by the average household or nonhousehold. Thus, the maximum potential fraction (or penetration potential) of bills and statements that could be diverted to EFT is 0.9, as shown in table 5. OTA assigned an initial growth rate of 20 percent, as indicated in table 5. Given the nature of the logistic substitution process, a 20-percent initial growth rate would decline to a 5-percent growth rate for the 20th year out. It would take 20 years to progress from 5 to 75 percent of the maximum potential diversion. The year of 5-percent diversion (time when 5-percent diversion occurs) was estimated to be 1985. The year of 75-percent diversion was estimated to be 2005. As shown in table 5, this growth rate is generally consistent with rates of growth projected by industry for key EFT technologies.

Likewise, the results of the OTA study suggest that EFT is likely to displace checks and other paper-based negotiable instruments, but that this displacement will take many years. OTA has assumed that all such instruments eventually could be displaced by EFT. Thus, the EFT penetration potential is 1.0 for negotiable instruments sent to households or nonhouseholds. As with bills and financial statements, OTA has assigned an initial growth rate of 20 percent and estimated the year of 5-percent diversion to be 1985. (See app. A, table A-3, for details.)

The OTA assumptions for bills and financial statements and for negotiable instruments were optimistic in the sense that the actual penetration potential might be lower than 0.9 and 1.0, respectively. Therefore, the actual EFT penetration is more likely to be lower than assumed. EFT was defined, in effect, as an all-electronic service completely outside of the mailstream. The assumptions about EFT may be affected by various intangible considerations important to EFT and EMS users, especially those relating to consumer preferences and institutional marketing strategies.

---

[4] See OTA report *Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity*, OTA-BP-CIT-12, March 1982. See also *EFT: The Next Fifteen Years*, Electronic Banking, Inc., June 1980, a working paper prepared for the above report.

# EMS Diversion

As noted earlier, the residual mail volume in each mail segment after EFT diversion is the potential market for EMS diversion. EMS diversion is divided between Generation II and Generation III and was calculated through use of the same logistic substitution process used for estimating EFT diversion (see app. B). The terms Generation II and Generation III are explained and compared in figure 2.

The EMS diversion model was based on a set of EMS technology assumptions discussed below, highlighted in table 6, and detailed in appendix A (table A-4). The assumptions relate to the following six categories of technology as applied to the various combinations of mail content and sender/receiver pairs:

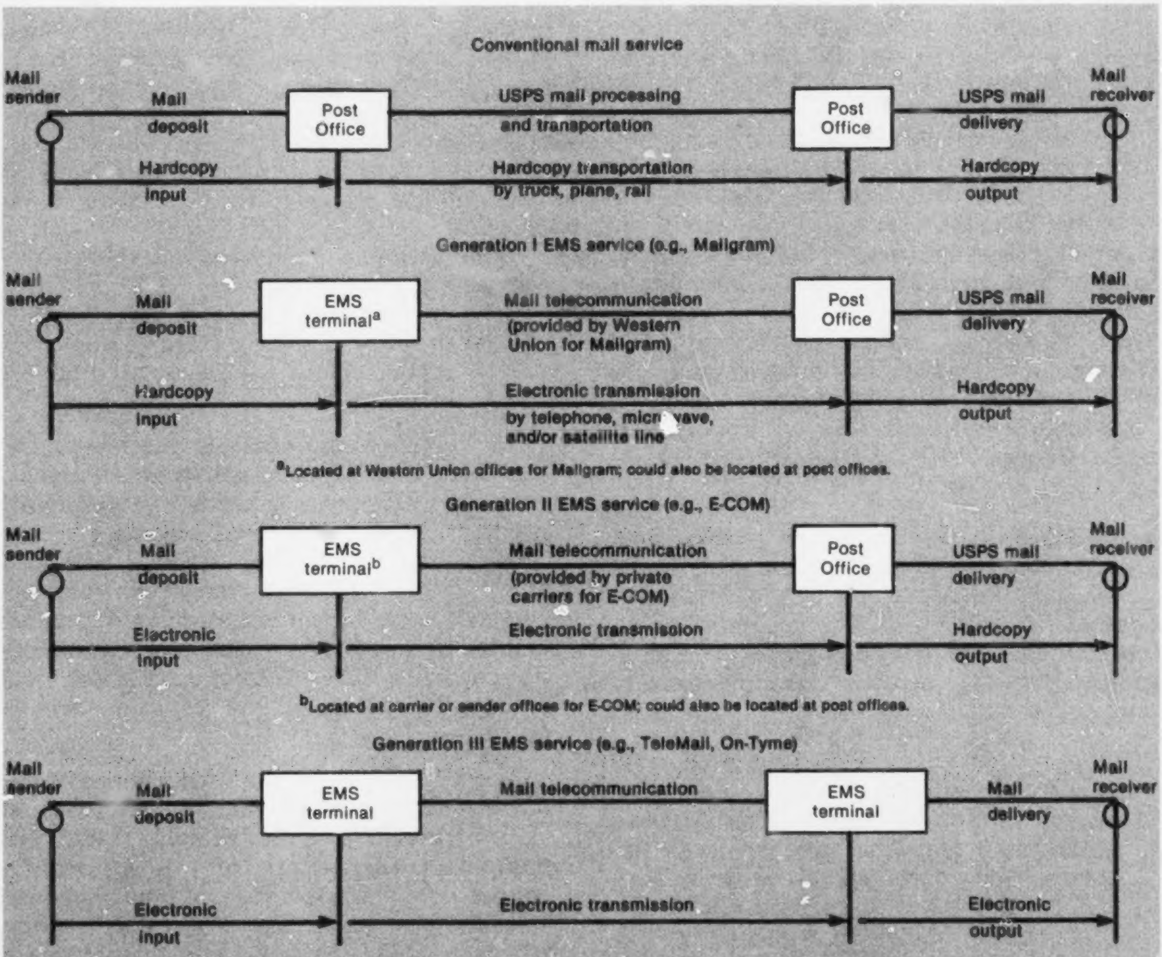
1. Generation II EMS systems with early electronic printers (no color). This category includes such industry offerings as Mailgram, Datapost and Tyme-Gram, and USPS offerings such as E-COM.
2. Generation II EMS systems with advanced electronic printers (including a color capability).
3. Electronic data processing and office automation. This category includes Generation III technologies such as computer networks, communicating word processors, public and private message and packet-switching networks, and facsimile systems oriented toward nonhousehold use.
4. Home computer terminals. Included are home computers and associated communications concepts/services such as PC Net (Personal Computer Network).
5. Viewdata/teletext. This category includes services, primarily to the home, based on the use of the television set and the telephone.
6. Inexpensive hardcopy receiver. Facsimile receivers or character printers at a price which could find acceptance in a majority of homes are included in this category.

The maximum market penetration potential was estimated for each mailstream segment. As with EFT, the assumptions about EMS penetration potential were optimistic in the sense that the actual penetration potential might be lower due to restrained consumer acceptance and other intangible factors. In most instances, the entire segment was judged 100-percent susceptible to Generation II and Generation III EMS. The exceptions are as follows.

About 30 percent of the "other nonadvertising" segments (nonhousehold to nonhousehold and nonhousehold to household) is made up of pamphlets, newsletters, official documents, coupons, and stockholder communications. Items of this type were judged not likely to be susceptible to EMS technologies that are expected to achieve widespread use over the next 20 years. Hence a maximum potential penetration of 70 percent ($P = 0.7$) was estimated.

The displacement of direct mail "advertising" and greeting "cards" segments to the home (nonhousehold to household and household to household) by TV-based Generation III home terminals was judged to be limited by the constraints of the video medium. Thus, a maximum Generation III penetration potential of 30 percent (0.3) was estimated for these segments.

**Figure 2.—Comparison of Conventional Mail Service With Generations I, II, and III EMS Service**


Conventional mail service
Mail sender
Mail deposit
Post Office
USPS mail processing and transportation
Post Office
USPS mail delivery
Mail receiver
Hardcopy input
Hardcopy transportation by truck, plane, rail
Hardcopy output
Generation I EMS service (e.g., Mailgram)
Mail sender
Mail deposit
EMS terminal^a
Mail telecommunication (provided by Western Union for Mailgram)
Post Office
USPS mail delivery
Mail receiver
Hardcopy input
Electronic transmission by telephone, microwave, and/or satellite line
Hardcopy output
Generation II EMS service (e.g., E-COM)
Mail sender
Mail deposit
EMS terminal^b
Mail telecommunication (provided by private carriers for E-COM)
Post Office
USPS mail delivery
Mail receiver
Electronic input
Electronic transmission
Hardcopy output
Generation III EMS service (e.g., TeleMail, On-Tyme)
Mail sender
Mail deposit
EMS terminal
Mail telecommunication
EMS terminal
Mail delivery
Mail receiver
Electronic input
Electronic transmission
Electronic output

[a] Located at Western Union offices for Mailgram; could also be located at post offices.

[b] Located at carrier or sender offices for E-COM; could also be located at post offices.

NOTES: For Mailgram and E-COM, USPS provides printing and enveloping of hardcopy output on post office premises, as well as delivery.

Technically, Mailgram is both a Generation I and II EMS service. Mailgram customers can call in messages electronically by phone to Western Union where the message is typed directly into an EMS terminal, or customers can bring hardcopy messages to a Western Union office for electronic entry.

Likewise, E-COM, although initially operating in a Generation II mode, could also offer Generation I service if EMS terminals are located at post offices to accept hardcopy input, as proposed in the EMSS concept.

In general, Generations II and III EMS services can be designed to accept hardcopy as well as electronic input. Generation III EMS can be designed to provide hardcopy as well as electronic output.

EMS = Electronic mail and message system.
E-COM = Electronic computer-originated mail.
EMSS = Electronic message service system.

SOURCE: Office of Technology Assessment; and National Academy of Sciences, *Electronic Message Systems for the U.S. Postal Service*, 1976.

**Table 6.—Assumptions About Rate of EMS Penetration (illustrative)**

Early Generation II EMS (using current technology black and white printers) for correspondence, bills, third-class bulk mail:
- Year of 5 percent penetration—1983
- Year of 75 percent penetration—1996
- Initial exponential growth rate (1983)—30 percent

Advanced Generation III EMS (using inexpensive home hardcopy receiver) for nonhousehold to household bills and statements:
- Year of 5 percent penetration—1990
- Year of 75 percent penetration—2010
- Initial growth rate—20 percent

Advanced Generation II EMS (using high resolution color printers) for advertising, greeting cards:
- Year of 5 percent penetration—1995
- Year of 75 percent penetration—2015
- Initial growth rate (1995)—20 percent

Generation III EMS (using public and private message and packet-switching networks, communicating word processors, computer networks) for intraoffice correspondence:
- Year of 5 percent penetration—1983
- Year of 75 percent penetration—1996
- Initial growth rate (1983)—30 percent

for interoffice correspondence:
- Year of 5 percent penetration—1984
- Year of 75 percent penetration—2004
- Initial growth rate (1984)—20 percent

Generation III EMS (using viewdata/teletext) for household to household cards:
- Year of 5 percent penetration—1985
- Year of 75 percent penetration—2005
- Initial growth rate—20 percent

Advanced Generation III EMS (using home computer terminals) for household to household correspondence:
- Year of 5 percent penetration—1987
- Year of 75 percent penetration—2007
- Initial growth rate (1987)—20 percent

for nonhousehold to household correspondence and bulk mail:
- Year of 5 percent penetration—1987
- Year of 75 percent penetration—1997
- Initial growth rate (1987)—40 percent

***Key technologies:***

Home computers:
- 500,000 installed (1980)
- Estimated by industry to grow to 4.5 million installed by 1985 and 33 million by 1990 (roughly a 50 percent annual growth rate).

Video computer games:
- Revenues increased from $308 million in 1978, to $968 million in 1979, to $2.8 billion in 1980 (roughly a 300 percent annual growth rate).

Mini and small business computers:
- Revenues of about $9.4 billion worldwide (1980)
- Estimated by industry to continue to grow at 25 to 35 percent a year.

Computer software products:
- Revenues of about $1.5 billion (1980)
- Estimated by industry to grow at 30 percent annually over the next 5 years.

Data communications:
- Estimated revenues of about $4 billion (1979) and growing at 30 to 35 percent a year.

SOURCE: Office of Technology Assessment; see app. A, table A-4, for further details.

## Generation II Growth and Timing Estimates

The attractiveness of Generation II services is determined primarily by the capabilities and cost effectiveness of the devices for converting the electronic signals back to hardcopy. Devices that have black and white capability only and limitations in page size and print style are frequently not as attractive as conventionally printed material. Also, printing systems must be very cost effective or EMS prices will be too high to compete successfully with conventional mail.

For the purposes of this study, OTA assumed that the electronic printers available in the 1980's will be limited in resolution and flexibility and will lack color capabilities. Advanced electronic printers, which are expected to become available at cost-effective prices in the 1990's, will add greater resolution, grey scale, and color capabilities and probably will include greater flexibility in materials handling. Recent technology and product announcements suggest that advanced printers may be available earlier than assumed for this study.

Generation II EMS services using early electronic printing capabilities, if priced competitively with mail service, could begin to find substantial use by nonhousehold senders in the next few years. For correspondence, bulk statements, and other nonadvertising content, OTA estimated a 5-percent diversion of existing mail to Generation II EMS by 1983, with a high initial rate of growth (30 percent) which could lead to a 75-percent market share about 13 years thereafter, as summarized in table 6. The use of Generation II for advertising purposes, however, is expected to be largely delayed until color capabilities become available, and even then growth will be slower to the extent that cost and relative inflexibility continue to limit the advantages of electronic color printing over conventional printing. Thus, for the advertising segment (nonhousehold to nonhousehold and nonhousehold to household) a 5-percent market share was forecast for 1995, with an initial growth rate of 20 percent.

Households will not be able to initiate a significant volume of Generation II EMS until home terminals capable of originating text come into widespread use. About 500,000 home computers had been sold by 1980,[5] though many of these were not equipped for communications. OTA assumed that it will take several more years before 5 percent of households, or roughly 4 million homes, are equipped with communications-capable home computers, and that there will be additional delays before many of these home computers are used routinely for correspondence. Thus, OTA assumed that the EMS market share for correspondence originating in the home will not reach 5 percent before 1987. A high initial growth rate (30 percent) was projected, which is consistent with growth rates projected by industry for home computers, as indicated in table 6.

The requirement for a color capability is expected to put greeting cards in the same position as advertising, thus delaying a 5-percent market share for Generation II EMS until 1995.

## Generation III Growth and Timing Estimates

Generation III EMS services between nonhousehold senders and receivers are expected to be based largely on electronic data-processing and office automation technologies. There are strong incentives within this sector for keeping information in electronic form and for machine processing by the receiver. As a result of these incentives, there is a healthy competition among several technologies for this market, including word processors, computer-based message systems, intelligent communication networks, and store and forward message systems. Until recently, this competition has tended to impede the development of standards among different vendors supporting each technology, and for information exchange between systems based on the different technologies. The International Standard Organization, the Consultative Committee for International Telephone and Telegraph, and the U.S. standards groups continue to work on developing standards. The process of agreeing on and then implementing standards has been slow but appears to be accelerating. The time required to achieve and implement standards at a variety of system levels will be a principal determinant of the rate of growth of Generation III message systems within the nonhousehold sector.

The problem will be easiest to resolve within individual companies. OTA estimated a 5-percent market share for Generation II EMS in 1983, and initial growth at a fast rate (30 percent). As shown in table 6, OTA estimated a 75-percent market share for Generation III EMS intra-office correspondence in 1996. A slower initial growth rate (20 percent) was projected for interoffice correspondence due to incompatibility and the number of different standards issues involved. These rates of growth are generally consistent with industry projections (listed in table 6) for small business computers, computer software, and data communications.

The standards problem will begin to be resolved first for correspondence, which requires a minimum of content standardization. OTA estimated a 5-percent market share in this segment in 1984. Generation III will become attractive for bills and statements when the recipients can automatically process the information received. This requires considerable standardization of data elements and formats. OTA anticipated a slow penetration of these complex standards to other sectors, in part due to the software development required to employ them. Initially, exchanges frequently are likely to be via hand-carried or mailed computer tapes substituting for numerous paper documents. Five-percent penetration in this market for Generation III is not expected to occur until 1985.

---

[5] U.S. Congress, Office of Technology Assessment, *Computer-Based National Information Systems: Technology and Public Policy Issues*, OTA-CIT-146, September 1981.

Generation III systems will begin to replace advertising within the nonhousehold sector when "online" catalogs and order entry systems are implemented between corporate buyers and their suppliers. Such systems will require extensive software development and standardization. Thus, OTA projected an additional 2 years (compared to bills and statements) to reach a 5-percent penetration of advertising (1987).

Generation III systems involving the household as either sender or receiver will be paced by the rate of acceptance of one of three principal home terminal technologies—the home computer terminal, the video-based viewdata/teletext terminal, and the inexpensive home hardcopy receiver.

A home computer terminal or its equivalent will be required for households to originate correspondence. As discussed above, OTA projected that a 5-percent market share for message services using home terminals would occur about 1987. By that time, however, many standards issues relating to home computer services are likely to have been resolved. Hence, OTA assumed very rapid initial growth (40 percent) for Generation III correspondence and other nonadvertising messages between households and nonhouseholds.

For correspondence between households, Generation III EMS growth is expected to be slower, since both sender and receiver must be equipped with a terminal device. For example, with 50 percent of households equipped, only 25 percent of household pairs on the average would have a terminal available at both ends. For this reason, the projected initial growth rate for household-household Generation III EMS correspondence is slower (20 percent).

Viewdata/teletext systems are most likely to penetrate the advertising and greeting card segments involving household receivers, though the maximum penetration potential is limited. These systems are projected to achieve a 5-percent market share somewhat ahead of home computers—OTA estimated 1985. Advertising by viewdata/teletext is expected initially to grow very rapidly (40 percent), since it is paced only by availability of the home receiver. The greeting card segment is likely to grow slowly, again because of the requirement that both sender and receiver be equipped.

The use of Generation III EMS services to transmit bills and financial statements to households requires home terminals as a prerequisite. In addition, it seems likely that many consumers will desire a hardcopy of their statements or bills for tax records and other purposes, thus making consumers more reluctant to accept bills and statements over a viewdata-like terminal. OTA assumed that home hardcopy equipment sales will be delayed 3 years behind video terminal sales and will grow at a slower rate, thus affecting the use of Generation III for bills and statements. OTA estimated that inexpensive hardcopy printers capable of reproducing the contents of a TV display will be produced in volume quantities for under $200 (1980 dollars) per unit when market penetration reaches 5 percent (1990).

## Relationships Between Generation II and Generation III Estimates

Generation II growth rate and timing estimates are not assumed to have any significant effect on the rate or timing of mail diversion to EFT systems or on the rate and timing of Generation III growth. The latter assumption may seem surprising at first since Generation II and III are in some sense competing. However, while the decision to send messages by Generation II as opposed to conventional mail is almost entirely at the discretion of the sender, the decision to receive mail electronically—and hence via Generation III—is largely at the discretion of the receiver. Thus, if Generation III is available, the recipients of messages will elect Generation III instead of hardcopy delivery when it suits their purposes or is convenient to do so, regardless of whether the hardcopy comes from conventional mail or is the output of a Generation II system. Thus, the rate of penetration of Generation III is not likely to be significantly affected by the state of penetration of Generation II.

It may also be thought that Generation III is but a simple extension of Generation II—perhaps just running a telecommunication line from a Generation II terminus to the ultimate user. In this view, earlier introduction of Generation II would speed the introduction of Generation III. However, many Generation III EMS systems are quite different in character from Generation II EMS systems. Therefore, sending greeting cards by viewdata, transmitting bills or statements between computers, reading messages from a computer-based message system, or placing orders against a supplier using an online catalog and order entry system are not functional extensions of a store and forward message system like that which forms the basis for Generation II. Both developer and user decisions for Generation III message systems are expected to be quite independent of the status of Generation II.

## Alternative Generation II Growth and Timing Estimates

The assumptions outlined above for the growth and timing of Generation II EMS are intentionally on the high side (i.e., optimistic in terms of rate and extent of development), but still are plausible in terms of technical, economic, and market realities. Henceforth, this set of assumptions will be referred to as the baseline alternative for Generation II EMS development.

In order to test the sensitivity of the market penetration model and the projected mail volumes to changes in the baseline Generation II EMS assumptions, OTA has defined three other alternatives, as presented in table 7: 1) very high Generation II EMS growth, 2) moderate Generation II EMS growth, and 3) slow Generation II EMS growth. When compared to the 1977 estimates made by RCA for the USPS with respect to EMSS,[6] the baseline alternative (high but plausible Generation II growth) would project a peak volume of about 60 to 75 percent of the RCA peak of 25 billion messages. The very high growth alternative would project a peak of 110 to 130 percent of the RCA peak, and the slow growth alternative about 25 percent of the RCA peak. The moderate growth alternative would project a peak of 55 to 65 percent of the RCA peak, but would show a growth track substantially slower than the baseline alternative but faster than the slow growth alternative. (See ch. 4, fig. 8, for a graphical comparison.)

**Table 7.—Assumptions for Generation II Growth Alternatives**

***High but plausible*** Generation II EMS growth (baseline alternative):
- Peak volume (year 1995) about 60 to 75 percent of RCA projected year 2000 volume
- Early Generation II—5 percent penetration in 1983
  initial growth rate 30 percent
- Advanced Generation II—5 percent penetration in 1995
  initial growth rate 20 percent

***Very high*** Generation II EMS growth:
- Peak volume (year 1995) about 110 to 130 percent of RCA projected year 2000 volume
- Early Generation II—5 percent penetration in 1983
  initial growth rate 40 percent
- Advanced Generation II—5 percent penetration in 1992
  (accelerated by 3 years)
  initial growth rate 30 percent

***Moderate*** Generation II EMS growth:
- Early Generation II—5 percent penetration in 1987
  (delayed by 4 years)
- Peak volume (year 2000) same as *very high* alternative peak in 1995
- Advanced Generation II—5 percent penetration in 1993
- Initial growth rates same as *very high* growth alternative

***Slow*** Generation II EMS growth
- Peak volume (year 2000) about 25 percent of RCA projected year 2000 volume
- Generation II growth rates cut in half compared to moderate growth alternative—20 percent for Early Generation II
  —15 percent for Advanced Generation II

SOURCE: Office of Technology Assessment (see fig. 8, ch. 4, for graphic comparison of alternatives).

---

[6] RCA Government Communications Systems Division, *Electronic Message Service System: Growth and Economic Analyses*, Camden, N.J., 1977, p. 6-13.

These alternatives are used in later chapters to test the sensitivity of the projected mail volumes, first-class revenues and costs, and labor force requirements to assumptions about the growth and timing of Generation II EMS.

# Underlying Mailstream Growth

Between 1970 and 1980, the overall volume of mail handled by USPS grew at an annual compounded rate of about 2.2 percent. Between 1900 and 1977, the annual compounded rate of growth was about 2.0 percent. Therefore, OTA used an estimate of 2 percent as the baseline underlying rate of growth in the mailstream. In other words, absent any diversion, it was assumed that the mailstream would grow by about 2 percent per year over the next 20 years (the timeframe of this study).

However, there are several indications that this assumption may be on the low side. For example, the University of Michigan study estimated an annual mailstream growth rate of 2.9 percent prior to technological diversion.[7] Also, in 3 of the last 4 years the actual rate of growth in the mailstream exceeded even this 2.9 percent level.* The USPS estimated rate of growth for fiscal year 1981 is 3.5 percent.[8] Finally, between 1947 and 1977, the annual compounded mailstream growth was about 3.2 percent.

Table 8 summarizes the various justifications for assuming a 2- v. a 3-percent underlying mailstream growth rate. The balance of evidence appears to suggest that a 2- or even 1-percent rate is typical of economically depressed periods, while the rate has been 3 percent or more during better economic times.

**Table 8.—Alternative Assumptions About Underlying Mailstream Growth Rate**

*Justifications for 3-percent underlying growth rate*

1947-77 average mailstream growth = 3.2 percent per year

1977-81 average mailstream growth = 4.2 percent per year

1951-77 average first-class mail growth = 2.8 percent per year

University of Michigan mailstream study estimate[a] = 2.9 percent per year

*Justifications for 2-percent underlying growth rate*

1970-80 average mailstream growth = 2.2 percent per year

1900-77 average mailstream growth = 2.0 percent per year (includes 1930's depression and both World Wars)

1951-77 ratio of first-class mail to disposable personal income declined from 76 million letters per $1 billion to 57 million letters per $1 billion[b]

*Justifications for 1-percent underlying growth rate*

1971-76 average mailstream growth = 1.1 percent per year

1971-76 average first-class mail growth = 0.7 percent per year

[a] M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report*, prepared for USPS Mail Classification Division, 1978.

[b] John F. McLaughlin, et al., *Telephone-Letter Competition: A First Look*, Harvard University, 1979.

SOURCE: Office of Technology Assessment.

These possibilities were accommodated in the market penetration model by making sensitivity runs of the model under different sets of assumptions, and by adjusting all results upward by 10 percent to be consistent with the estimated fiscal year 1981 USPS overall mail volume. Sensitivity runs were carried out for both a higher (3 percent) and a lower (1 percent) underlying mailstream growth rate. The results of selected sensitivity runs are presented in chapter 4.

The one-time 10-percent adjustment in results for consistency with 1981 data was needed because the actual mailstream growth during the 1977-81 period far exceeded the 2-percent annual rate that was assumed initially. As noted in chapter 4, the market diversion model was based on 1977 mailstream data, which was the only detailed data available at the time of the study. The model assumed that, under the baseline growth of 2 percent per year, the total mail volume would grow from about 93 billion pieces in 1977 to about 100 billion pieces in 1981. The actual USPS mail volume grew from about 92 billion pieces in 1977 to an estimated 110 billion pieces for fiscal year 1981.[9] In order to compensate for this higher-than-expected growth rate, all results of the computer modeling were increased by 10 percent to make the projected and actual figures for 1981 consistent and to remove the effects of the 1977-81 growth discrepancy from future year projections. Without the 10-percent adjustment, future year projections would have been penalized for this discrepancy.

---

[7] Kallick, Rodgers, et. al., op. cit.

*5.1 percent for fiscal year 1978; 2.9 percent for fiscal year 1979; 6.5 percent for fiscal year 1980; and 3.5 percent (estimated) for fiscal year 1981.

[8] Per Nov. 22, 1981, telephone conversation with Lou Eberhardt, USPS Public Information Office.

---

[9] Ibid.

# Chapter 4

# Market Penetration Results

# Contents

Page
Introduction .......... 37

Base Case Results .......... 37

Sensitivity Analyses .......... 40
  Three-Percent Underlying Growth Rate .......... 40
  Other Sensitivity Runs .......... 42

Comparison of Alternative Generation II EMS Growth and Timing Estimates .......... 45

## TABLE

*Table No.* — *Page*
9. Sensitivity Analyses .......... 44

## FIGURES

*Figure No.* — *Page*
3. Market Penetration for High But Plausible Generation II EMS Growth Alternative .......... 38
4. Breakdown of Mail by Class for High But Plausible Generation II EMS Growth Alternative .......... 39
5. Market Penetration for High But Plausible Generation II EMS Growth Alternative .......... 40
6. Breakdown of Mail by Class for High But Plausible Generation II EMS Growth Alternative .......... 41
7. Sensitivity Analyses of Market Penetration Projections Assuming High But Plausible Generation II EMS Growth .......... 43
8. Generation II EMS Market Projections .......... 47

Chapter 4

# Market Penetration Results

## Introduction

This chapter presents the results of the market penetration analysis using the model and technology assumptions described in chapter 3. The primary use of the model here is to estimate future levels of conventional and electronic mail volumes under a variety of conditions.

To recap, the starting point for the model is the baseline mailstream, which is then broken down into a number of different submarkets (classes or subclasses of mail). The model estimates the maximum potential fraction of each submarket which appears to be suitable for handling by (i.e., diverted to) electronic funds transfer (EFT) or electronic mail and message systems (EMS). Then, based on specific assumptions about the relevant technology, the model estimates the rate and timing of penetration of EFT and/or EMS into each submarket.

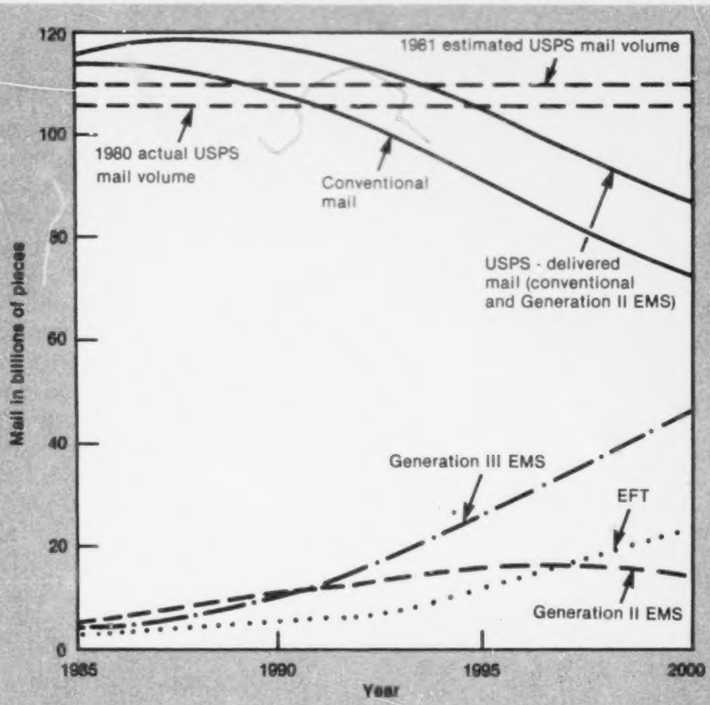
For each submarket, the model is thus able to estimate the portion of the mailstream that would be diverted to EFT and EMS and the portion that would remain as conventional mail. OTA has assumed that, unless otherwise indicated, the U.S. Postal Service (USPS) would deliver the hardcopy output of EMS services but not the electronic output. The portion of the mailstream diverted to EMS is further divided into Generation II (defined as EMS with hardcopy output and delivery) and Generation III (defined as EMS with electronic delivery). The total remaining USPS mailstream for any given set of assumptions will then be the sum of all submarkets of undivertable conventional mail (mail not suitable for electronic handling), plus residual conventional mail (mail that is suitable for electronic handling but has not yet been diverted), plus Generation II EMS volume. As defined in this study, Generation III EMS and EFT both involve electronic delivery and therefore are assumed to be completely outside of the USPS mailstream.

## Base Case Results (High But Plausible Generation II EMS Growth, 2-Percent Underlying Mailstream Growth)

The results of the market penetration analysis for the high but plausible Generation II EMS growth alternative under the baseline assumptions are shown in figure 3.

Under the base case, assuming a 2-percent growth rate in the underlying mailstream, USPS-delivered mail (conventional plus Generation II EMS) would rise to about 118 billion pieces by 1990 and then decline to about 89 billion pieces in 2000. By 1995, USPS-delivered mail would be about equal to the 1980 USPS mail volume of 106 billion pieces. Conventional mail would have declined significantly as a percentage of total mail, from about 94 percent in 1985 to only 47 percent in 2000. Thus, conventional mail would constitute less than one-half of the total mailstream, although still representing a substantial absolute volume of about 75 billion pieces. In contrast, the combined total of EFT and EMS would have risen from about 5.6 percent of the total mailstream in 1985 to about 53 percent in 2000. Of the roughly 85 billion pieces of "electronic" mail in 2000, Generation III EMS would account for about 56 percent,

**Figure 3.—Market Penetration for High But Plausible Generation II EMS Growth Alternative (assuming 2% growth in underlying mailstream)**



| Type of mail | 1985 | 1990 | 1995 | 2000 |
|---|---|---|---|---|
| | Volume of mail by year (billions of pieces) | | | |
| Conventional | 113.16 | 109.16 | 90.73 | 75.10 |
| EFT | 1.78 | 4.92 | 12.15 | 24.63 |
| Generation II EMS | 2.51 | 9.05 | 15.48 | 13.43 |
| Generation III EMS | 2.44 | 9.34 | 27.91 | 48.33 |
| Total | 119.89 | 132.47 | 146.26 | 161.48 |
| USPS - delivered (conventional and Generation II EMS) | 115.77 | 118.21 | 106.20 | 88.52 |

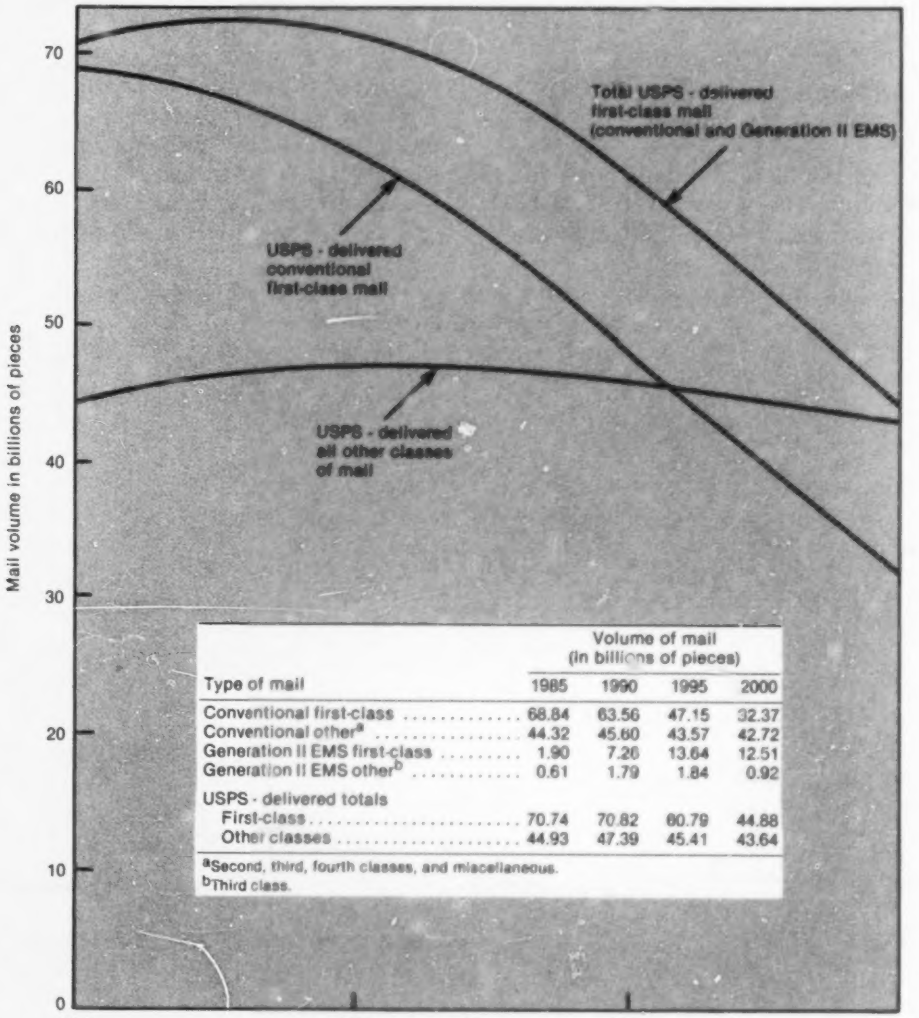
SOURCE: Office of Technology Assessment.

EFT about 28 percent, and Generation II EMS about 17 percent. By 2000, Generation III EMS and EFT would still be increasing at a fairly rapid rate, while Generation II EMS would have peaked and started to decline.

Overall, the picture that emerges is one where conventional mail volume would decline by about 32 percent by 2000 compared to the 1981 volume of 110 billion pieces. USPS-delivered mail would decline somewhat less—by about 20 percent—due to the offsetting effect of increases in Generation II EMS volume. However, this Generation II EMS "cushion" would peak about 1995 and be on the decline by 2000 in the face of competition from Generation III EMS.

The breakdown of USPS-delivered mail among the various classes of mail would also change significantly. As shown in figure 4, the split in conventional mail between first class and all other classes would essentially reverse. In 1985, first-class conventional mail would account for about 61 percent of total conventional mail, and all other classes would account for about 39 percent. This is essentially the same as the split indicated by actual fiscal year 1980 mail volume statistics. By 2000, however, first-class conventional mail would account for only about 43 percent of total conventional mail, while the share for all other classes of mail would increase to 57 percent. When Generation II EMS first-class mail is taken into account, all first-class mail (conventional plus Generation II EMS) declines some-

**Figure 4.—Breakdown of Mail by Class for High But Plausible Generation II EMS Growth Alternative (assuming 2% growth in underlying mailstream)**



| Type of mail | Volume of mail (in billions of pieces) | | | |
|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 |
| Conventional first-class | 68.84 | 63.56 | 47.15 | 32.37 |
| Conventional other[a] | 44.32 | 45.60 | 43.57 | 42.72 |
| Generation II EMS first-class | 1.90 | 7.26 | 13.64 | 12.51 |
| Generation II EMS other[b] | 0.61 | 1.79 | 1.84 | 0.92 |
| USPS - delivered totals | | | | |
| First-class | 70.74 | 70.82 | 60.79 | 44.88 |
| Other classes | 44.93 | 47.39 | 45.41 | 43.64 |

[a] Second, third, fourth classes, and miscellaneous.

[b] Third class.

SOURCE: Office of Technology Assessment.

what less as a percentage of total USPS-delivered mail. However, even including Generation II EMS, the split between first class and all other classes of mail would change from 61/39 in 1985 to essentially an even split (51/49) in 2000. Given the revenue/cost structure of USPS, this change could have significant implications for USPS revenues, rates, and competitive posture, as will be discussed later.

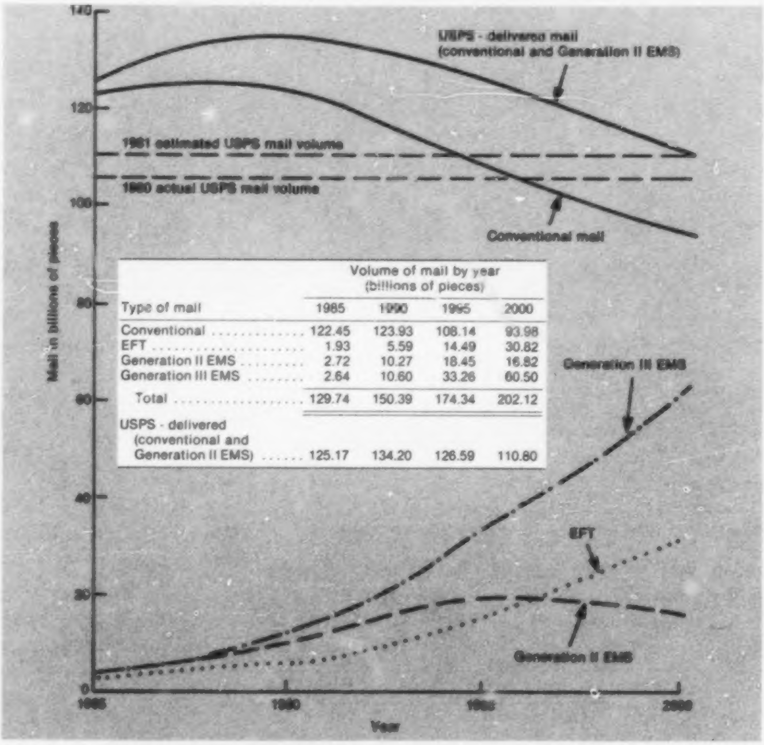
## Sensitivity Analyses

Several computer runs were performed to determine the sensitivity of the base case results to changes in key variables and/or assumptions.

### Three-Percent Underlying Growth Rate

As discussed in chapter 3, the growth in USPS mail volume since World War II has averaged over 3 percent compounded annually. A 3-percent growth rate can be justified on the several grounds summarized earlier in table 10. Some researchers believe that a 3-percent rate should be defined as the baseline rather than 2 percent. Figure 5 shows the results of the market penetration analysis for high but plausible Generation II EMS growth, assuming a 3- rather than a 2-percent underlying growth rate in the mailstream. The differences from the base case are significant. USPS-delivered mail would peak at about 134

**Figure 5.—Market Penetration for High But Plausible Generation II EMS Growth Alternative (assuming 3% growth in underlying mailstream)**

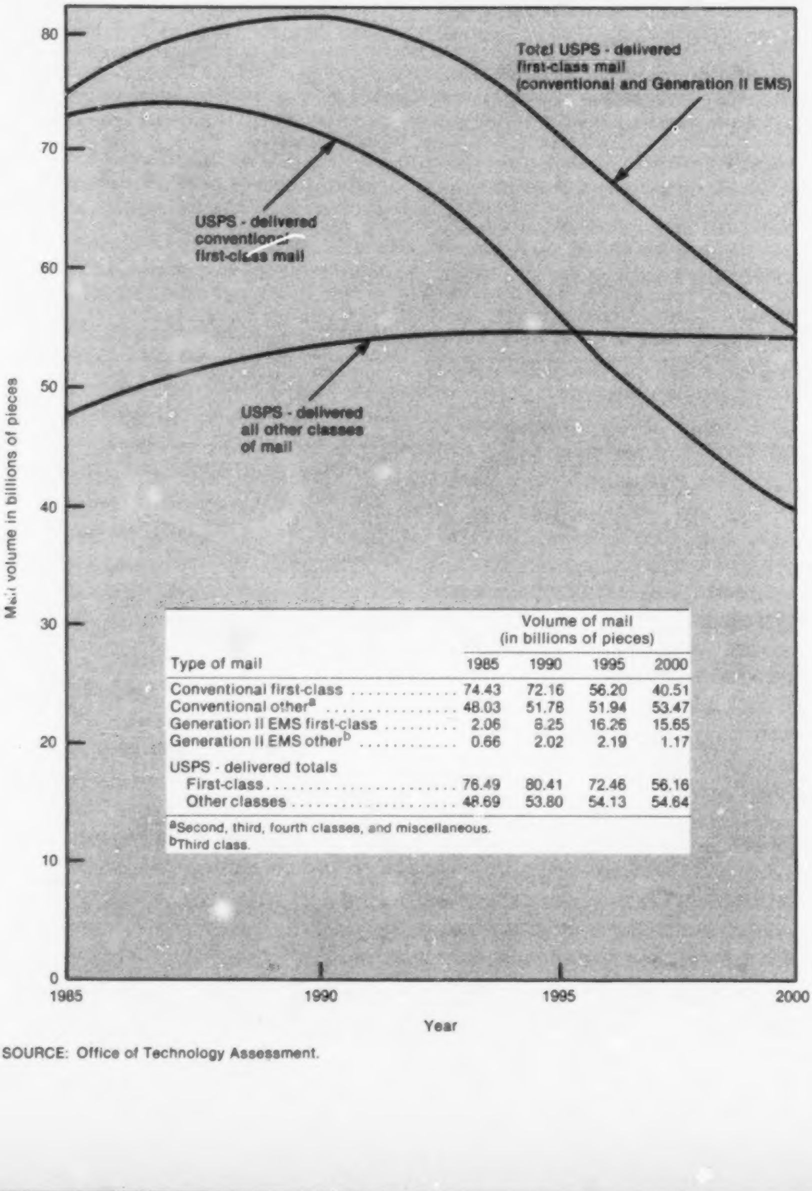


| Type of mail | Volume of mail by year (billions of pieces) | | | |
|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 |
| Conventional | 122.45 | 123.93 | 108.14 | 93.98 |
| EFT | 1.93 | 5.59 | 14.49 | 30.82 |
| Generation II EMS | 2.72 | 10.27 | 18.45 | 16.82 |
| Generation III EMS | 2.64 | 10.60 | 33.26 | 60.50 |
| Total | 129.74 | 150.39 | 174.34 | 202.12 |
| USPS - delivered (conventional and Generation II EMS) | 125.17 | 134.20 | 126.59 | 110.80 |

SOURCE: Office of Technology Assessment.

billion pieces in 1990 and decline to slightly more than 110 billion pieces in 2000. Thus, if the underlying growth rate in the mailstream equals or exceeds 3 percent annually, USPS-delivered mail volume would exceed 1981 levels at least through 2000. In other words, with a 3-percent underlying growth rate, the USPS-delivered mail volume (conventional plus Generation II EMS) would not drop below the estimated 1981 volume of 110 billion pieces until 2000. Even the conventional mail volume would not drop below 110 billion pieces until roughly 1994. The relative breakdown of mail by class would not be significantly different for an underlying growth of 3 percent as compared with 2 percent, but the volumes for all types of mail would be significantly higher, as indicated in figure 6.

**Figure 6.—Breakdown of Mail by Class for High But Plausible Generation II EMS Growth Alternative (assuming 3% growth in underlying mailstream)**



| Type of mail | Volume of mail (in billions of pieces) | | | |
|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 |
| Conventional first-class | 74.43 | 72.16 | 56.20 | 40.51 |
| Conventional other[a] | 48.03 | 51.78 | 51.94 | 53.47 |
| Generation II EMS first-class | 2.06 | 8.25 | 16.26 | 15.65 |
| Generation II EMS other[b] | 0.66 | 2.02 | 2.19 | 1.17 |
| USPS - delivered totals | | | | |
| First-class | 76.49 | 80.41 | 72.46 | 56.16 |
| Other classes | 48.69 | 53.80 | 54.13 | 54.64 |

[a] Second, third, fourth classes, and miscellaneous.

[b] Third class.

SOURCE: Office of Technology Assessment.

## Other Sensitivity Runs

In order to fully test the sensitivity of the base case results to changes in key assumptions, several other sensitivity runs were conducted. The results are summarized in figure 7. The projected USPS-delivered mail volumes would be higher than the base case if: 1) EFT growth rates were cut in half (half of what were assumed for the base case); 2) the underlying growth in the mailstream was 3 percent rather than 2 percent (discussed earlier); 3) 5-percent penetration of Generation III EMS was delayed 3 years; or 4) Generation II EMS stimulated 100 percent additional traffic. If two or more of these changes from the base case occurred simultaneously, the projected USPS-delivered mail volume would be even higher than shown in figure 6.

On the other hand, the projected USPS mail volumes would be lower than the base case if: 1) Generation III penetration was accelerated by 3 years; 2) USPS did not deliver 100 percent of industry Generation II EMS hardcopy output; 3) the underlying growth in the mailstream was 1 percent rather than 2 percent; or 4) a large percentage of second- and third-class mail was lost to alternative delivery services. Again, if two or more of these changes from the base case occurred at the same time, the projected USPS-delivered mail volumes would be even lower than indicated in figure 7.

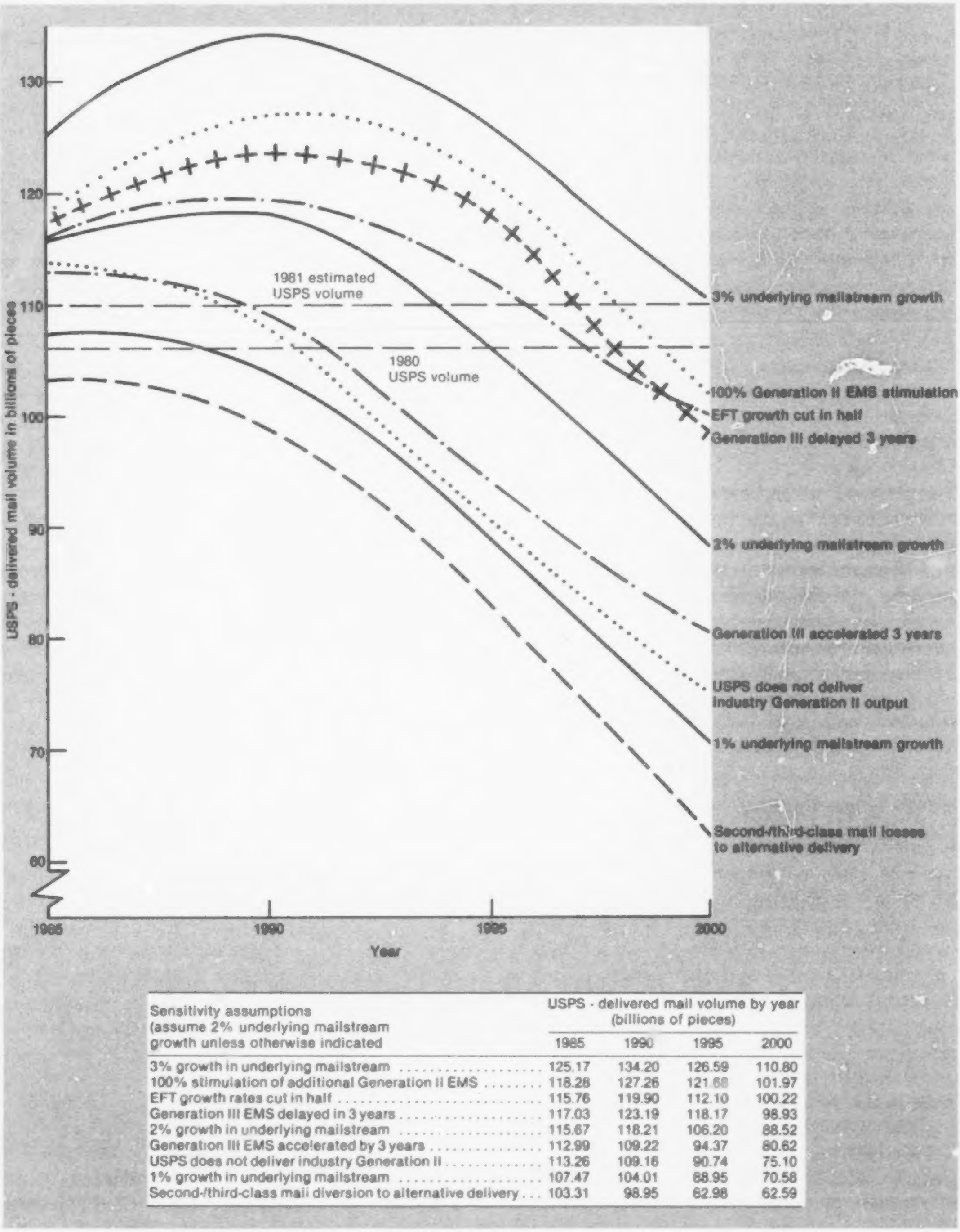
OTA's qualitative evaluation of the likelihood of various changes is summarized in table 9. With respect to changes that would reduce mail volume compared to the base case, OTA concluded that a 1-percent underlying mailstream growth rate, a doubling of the initial EFT growth rate (from 20 to 40 percent), and an acceleration of the year of 5-percent Generation III penetration (from 1987 to 1984) were all unlikely, as was a significant reduction in USPS delivery of industry Generation II hardcopy output (short of a major revision in the Private Express Statutes). OTA did conclude that significant diversion of second- and third-class mail to alternative delivery services was possible, although probably not at the rate assumed in the sensitivity run shown in figure 7.

With respect to changes that would increase projected mail volume compared to the base case, OTA concluded that while a 4-percent underlying mailstream growth rate was unlikely, a 3-percent rate was quite possible, given growth trends during periods of economic prosperity. However, the current uncertainty in the short- and long-term economic outlook suggested to OTA that a 3-percent underlying growth rate assumption would have to be considered somewhat optimistic. OTA also concluded that reductions in the base case rates of development for EFT and Generation III EMS were possible, due to marketing and competitive (and, in the case of EFT, regulatory) uncertainties. On the other hand, technology per se does not appear to be a limiting factor, and the sales of home computers, computer games, and small business computers are indicative of rapid development. As for the stimulation of additional Generation II EMS volume, OTA could not determine whether the experience with all-electronic technologies (e.g., telephone) is applicable. Some stimulation of additional messages, although probably considerably less than the 100-percent stimulation assumed in the sensitivity run shown in figure 7, seems possible. This and two other sensitivity runs are discussed in more detail below.

**One-Hundred-Percent Stimulation of Generation II EMS Traffic.**—The base case assumed that Generation II EMS traffic would be diverted on a one-for-one basis from the conventional mailstream; that is, Generation II EMS volume is subtracted from the conventional mail volume. In actual practice, Generation II EMS systems might stimulate additional traffic, rather than just diverting conventional mail traffic.

Experience with other electronic communication services suggests that the availability of Generation II EMS may indeed stimulate demand for new messages not presently sent through the mail at all. Figure 7 shows the

**Figure 7.—Sensitivity Analyses of Market Penetration Projections Assuming High But Plausible Generation II EMS Growth**



| Sensitivity assumptions (assume 2% underlying mailstream growth unless otherwise indicated | USPS - delivered mail volume by year (billions of pieces) | | | |
|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 |
| 3% growth in underlying mailstream | 125.17 | 134.20 | 126.59 | 110.80 |
| 100% stimulation of additional Generation II EMS | 118.28 | 127.26 | 121.68 | 101.97 |
| EFT growth rates cut in half | 115.76 | 119.90 | 112.10 | 100.22 |
| Generation III EMS delayed in 3 years | 117.03 | 123.19 | 118.17 | 98.93 |
| 2% growth in underlying mailstream | 115.67 | 118.21 | 106.20 | 88.52 |
| Generation III EMS accelerated by 3 years | 112.99 | 109.22 | 94.37 | 80.62 |
| USPS does not deliver industry Generation II | 113.26 | 109.16 | 90.74 | 75.10 |
| 1% growth in underlying mailstream | 107.47 | 104.01 | 88.95 | 70.58 |
| Second-/third-class mail diversion to alternative delivery | 103.31 | 98.95 | 82.98 | 62.59 |

SOURCE: Office of Technology Assessment.

**Table 9.—Sensitivity Analyses**

USPS-delivered mail volume would be reduced compared to the baseline projections if:

- Growth in underlying mailstream were 1 percent—*Unlikely*, except in event of economic depression.
- EFT growth rate doubled from 20 percent (in 1985) to 40 percent—*Unlikely*.
- Generation III EMS were accelerated by 3 years from 1987 (for 5 percent penetration) to 1984—*Unlikely*.
- Significant reduction in USPS delivery of private sector Generation II hardcopy output occurred—*Unlikely* under current USPS interpretation of Private Express Statutes (PES); however, FCC and some private firms believe that hardcopy output falls within the jurisdiction of the Communications Act, not the PES.
- Significant diversion of second-/third-class mail to alternative delivery occurred—*Possible;* some diversion known to be occurring, but second-class has remained essentially constant over last 10 years and third-class has increased by 52 percent. USPS rate increases may accelerate use of alternative delivery.

USPS-delivered mail volume would be increased compared to the baseline if:

- Growth in underlying mailstream were 4 percent—*Unlikely* over the long-term, although short-term growth spurts of 4 percent are possible.
- EFT growth rate were halved from 20 percent (in 1985) to 10 percent—*Possible* due to marketing, competitive, and regulatory uncertainties.
- Generation III EMS were delayed by 3 years from 1987 (for 5 percent penetration) to 1990—*Possible* due to marketing and competitive uncertainties; however, sales of home computers, computer games, and small business computers look very strong.
- Stimulation of additional Generation II EMS volume occurred—*Possible* given that other electronic technologies (e.g., telephone, computer conferencing) have generated additional message volume; however, whether experience with all-electronic technologies applies to hybrid forms (such as Generation II EMS) is unknown.
- Growth in underlying mailstream were 3 percent—*Quite possible* given the historical growth trends during periods of relative economic prosperity.

SOURCE: Office of Technology Assessment.

results of the market penetration analysis for high but plausible Generation II EMS growth, assuming 100-percent stimulation of EMS traffic. This means that for each message diverted from conventional mail to Generation II EMS, a new Generation II EMS message is generated.

Under this assumption, USPS-delivered mail would peak at about 127 billion pieces in 1990 and decline to a little over 100 billion pieces in 2000. USPS-delivered mail volume would exceed present levels through about 1998, although the conventional mail volume would drop below the present level by 1990. Generation II EMS volume would grow much faster and sooner, and would outpace Generation III EMS at least through about 1995. By comparison, in both the base case and the 3-percent underlying growth case, Generation III EMS would overtake Generation II EMS as early as 1990. Overall, a 100-percent stimulation of Generation II EMS traffic would result in a higher projected USPS-delivered mail volume than the base case, but not as high as the 3-percent underlying growth case. There is, however, a question as to whether the 100 percent EMS stimulation assumption is realistic.

**Generation III EMS Three Years Sooner.**—Generation III EMS involves end-to-end electronic service; that is, electronic delivery of mail as well as electronic sending and transmission. Electronic delivery requires that both senders and receivers of mail have the necessary terminal equipment. In developing the market penetration model, OTA made a number of assumptions about the growth of Generation III. For example, OTA projected that in 1987 home computer terminals (or their equivalent) would achieve a 5-percent share of mail segments involving the household as either sender or receiver. While this was OTA's best estimate based on economic, market, and technological conditions at the time of the study, the timing and rate of home computer development is a subject of considerable debate.

In order to test the sensitivity of the baseline market penetration results to Generation III, the model was run with all Generation III timing estimates advanced by 3 years. That is, 3 years were subtracted from all estimates of the year of 5-percent penetration for a particular Generation III technology and market segment. For example, the time to 5-percent penetration for home computer terminal penetration of household-to-household correspondence was changed from 1987 to 1984.

Under the base case, Generation II volume would be greater than Generation III volume through about 1990. With 100-percent EMS stimulation, Generation II volume would be greater through about 1996. But if Generation III came 3 years sooner than assumed in the base case, Generation II would never exceed Generation III. Even in the peak year (1995) for Generation II, Generation III EMS volume would be more than four times larger. By 2000, Generation III would be about 56 billion pieces (or messages) and rising rapidly, while Generation II would be about 9 billion pieces and declining.

As a result, the USPS-delivered mail volume would be less compared to the base case, since there would be less Generation II EMS hardcopy delivery to offset reductions in conventional mail delivery. As a consequence, by 1990 total USPS-delivered mail volume would fall below the current 1981 level of 110 billion pieces. By 2000, USPS-delivered mail volume would be down to about 81 billion, a reduction of about 27 percent from 1981. Thus, accelerating Generation III creates a worse case (in terms of USPS mail volume) than the base case.

**Second- and Third-Class Mail Losses to Alternative Delivery.**—As discussed earlier and presented in figure 4, first-class volume for the base case declines significantly as a percentage of total USPS-delivered mail. This is because first-class mail is most susceptible to diversion to EFT or Generation III EMS. Other classes of mail, primarily second and third classes, show very little decline over the next 20 years. The reduction in first-class mail might lead to a substantial increase in costs (and rates) for other classes of mail, since these other classes would have to cover a larger percentage of USPS fixed institutional costs. Rate increases could in turn lead to additional losses of second- and third-class mail.

In order to test the sensitivity to such losses, OTA conducted a run of the market penetration model assuming a 3-percent annual reduction in second-class mail and a 2-percent annual reduction in third-class mail. While these assumptions are fairly extreme, fourth-class mail has been declining annually by an average of 3 to 4 percent over the last few years. In contrast, third-class mail has increased significantly in recent years. However, both second- and third-class mailers are increasing their use of alternative means of distribution. For example, some third-class mailers are shifting to newspaper inserts. These are identical in purpose, content, and appearance to items commonly carried as bulk third-class mail and are much cheaper on a per piece basis than bulk third class. In the 1980 rate case filings before the Postal Rate Commission, many mailers indicated that they are close to the limit in terms of absorbing higher mail rates. The rates for second- and third-class mail have already risen by about 400 percent since 1970 as a result of steps required by the Postal Reorganization Act of 1970 to bring rates for all classes of mail in line with costs.

The impact of these assumptions is dramatic. USPS-delivered mail volume (conventional plus Generation II EMS) would start declining right away, and by 2000 would fall to about 63 billion pieces, about 43 percent below the 1981 mail volume. Conventional mail would decline to about 50 billion pieces, more than 50 percent below the current 110 billion pieces. Thus, this level of second- and third-class diversion clearly leads to the worst-case scenario with respect to USPS mail volume.

## Comparison of Alternative Generation II EMS Growth and Timing Estimates

Up to this point, all market penetration results have been for the baseline EMS alternative, which assumes a high but plausible rate of Generation II EMS development. In other words, for the base case as well as the various sensitivity runs, the Generation II

EMS growth and timing parameters have been held constant while other variables (e.g., EFT growth rate, Generation III 5-percent penetration date, underlying mailstream growth rate) have been changed. In order to test the sensitivity of the projected mail volumes to changes in the baseline Generation II EMS assumptions, computer runs were conducted for each of the four Generation II EMS alternatives defined in chapter 3 (table 7):

1. baseline alternative—high but plausible Generation II EMS growth;
2. very high Generation II EMS growth;
3. moderate growth; and
4. slow growth.

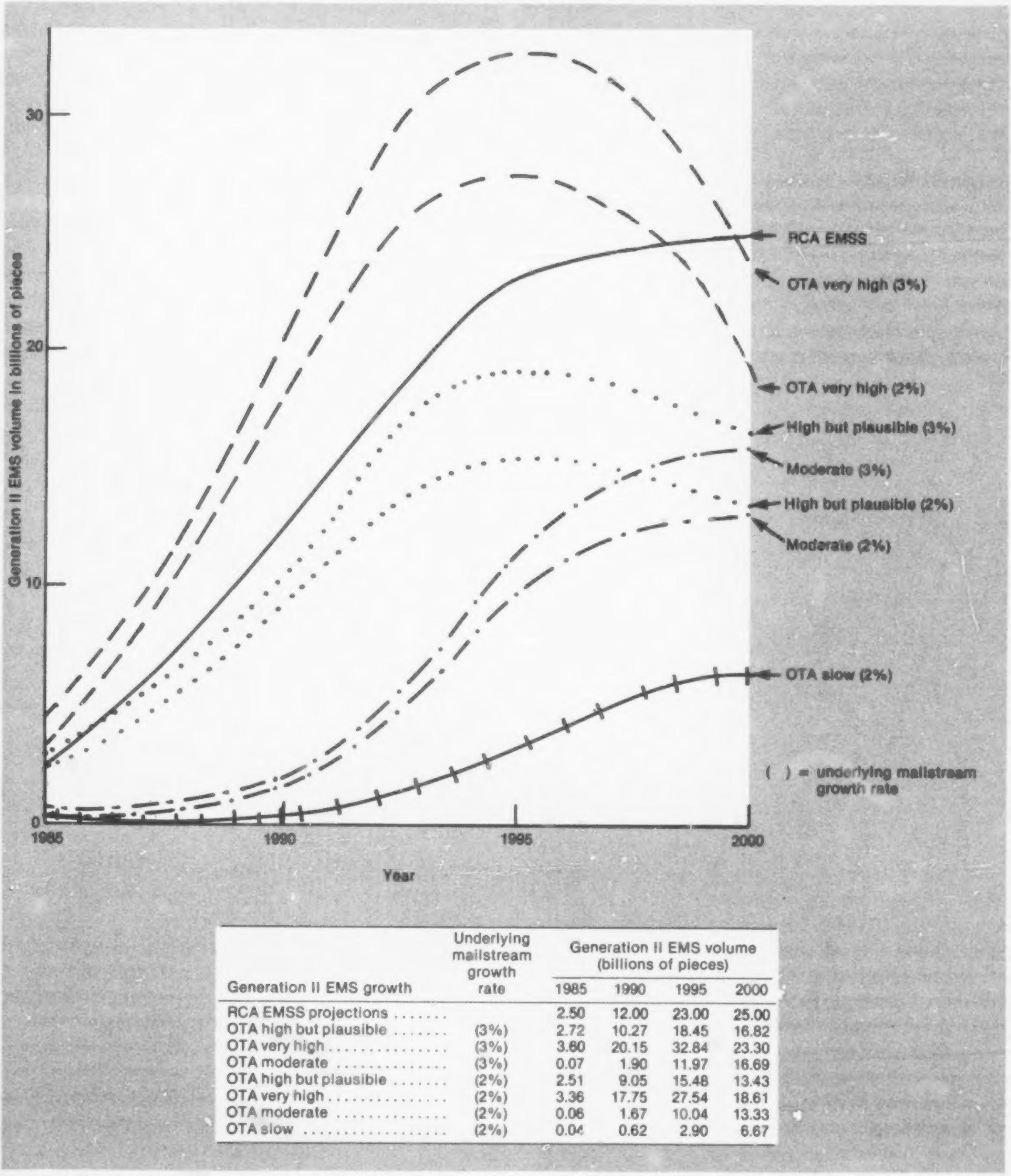
The Generation II EMS market projections for these four alternatives are presented in figure 8. Results are shown for both 2- and 3-percent underlying mailstream growth rates. The market projections developed by RCA (under contract to USPS for the electronic message service system concept, known as EMSS) are also included in figure 8 for comparison purposes.

As expected, projected volumes for the high but plausible Generation II growth alternative fall in the middle when compared to the very high, moderate, and slow alternatives. Somewhat surprisingly, however, volumes for the high but plausible alternative are considerably below the RCA projections. If this alternative is indeed a high but plausible market development scenario, as assumed by OTA, then it would appear that the RCA projections represent a very high (i.e., optimistic) market development scenario, that they have ignored competition with Generation III EMS services, or both. The size of the Generation II EMS market takes on considerable importance with respect to the actual deployment and pricing of any USPS EMS offering.

Based on the figure 8 results, it would appear that a conservative estimate (assuming slow to moderate Generation II growth and a 2-percent underlying mailstream growth) would place the year 2000 Generation II EMS volume in the range of 7 billion to 14 billion pieces, rather than the RCA estimate of 25 billion. Likewise, a conservative estimate would place the 1995 volume in the range of 3 billion to 10 billion pieces, rather than the 23 billion RCA estimate. If Generation II EMS growth actually followed the slow growth path, volume is projected to reach only 40 million pieces in 1985, equivalent to the volume of Mailgrams for fiscal year 1980. On the other hand, if Generation II EMS grows very rapidly, the projected volume would exceed the RCA estimates until the late 1990's. If a 3-percent underlying mailstream growth rate is assumed, the projected year 2000 volume of about 23 billion pieces for the high but plausible Generation II EMS alternative is essentially the same as the RCA estimate.

In sum, the projected mail volumes are very sensitive to the assumptions implicit in the four alternatives considered for Generation II EMS development.

## Figure 8.—Generation II EMS Market Projections



| Generation II EMS growth | Underlying mailstream growth rate | Generation II EMS volume (billions of pieces) | | | |
|---|---|---|---|---|---|
| | | 1985 | 1990 | 1995 | 2000 |
| RCA EMSS projections ........ | | 2.50 | 12.00 | 23.00 | 25.00 |
| OTA high but plausible ........ | (3%) | 2.72 | 10.27 | 18.45 | 16.82 |
| OTA very high ................ | (3%) | 3.60 | 20.15 | 32.84 | 23.30 |
| OTA moderate ................ | (3%) | 0.07 | 1.90 | 11.97 | 16.69 |
| OTA high but plausible ........ | (2%) | 2.51 | 9.05 | 15.48 | 13.43 |
| OTA very high ................ | (2%) | 3.36 | 17.75 | 27.54 | 18.61 |
| OTA moderate ................ | (2%) | 0.06 | 1.67 | 10.04 | 13.33 |
| OTA slow .................... | (2%) | 0.04 | 0.62 | 2.90 | 6.67 |

SOURCE: Office of Technology Assessment and RCA.

## Chapter 5

# Revenue/Cost Model and Results

# Contents

Page
Introduction . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 51
USPS Revenue/Cost Model for First-Class Conventional Mail . . . . . . . . . . . 51
USPS Revenue/Cost Model for First-Class Electronic Mail . . . . . . . . . . . . . 52
Results of the Revenue/Cost Analysis for First-Class Mail . . . . . . . . . . . . . 53

FIGURES

*Figure No.* *Page*
9. Contribution of USPS-Delivered First-Class Mail to USPS Fixed Costs . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . . 54
10. Contribution of USPS-Delivered First-Class Mail to USPS Fixed Costs for High But Plausible Generation II Growth Alternative . . . . . . . . . . 55

# Revenue/Cost Model and Results

## Introduction

This chapter describes the revenue/cost model used by OTA to project the impact of U.S. Postal Service (USPS) involvement in electronic mail and message systems (EMS) on its finances and outlines the results of the analysis. OTA originally intended to prepare projections of USPS revenues and costs for all classes of mail under the four alternatives considered for the years 1985, 1990, 1995, and 2000. However, the USPS revenue and cost structure proved to be too complex, and the available baseline data too ambiguous, to make complete projections. Instead, OTA has focused on the financial impacts for first-class mail which, according to the results of the market penetration analysis discussed in chapter 4, will be affected most by EMS. The revenue/cost model for conventional mail is described first, followed by the model for electronic mail.

## USPS Revenue/Cost Model for First-Class Conventional Mail

USPS revenue and cost relationships are unusually complex for several reasons. First, postal costs vary not only with the volume and weight of mail delivered, but also according to class of mail, number of route stops, speed of service standards, size and shape of mail, and whether (and how) the mail is ZIP-coded and presorted. Costs also may vary between urban, suburban, and rural routes, although USPS does not collect cost data based on mail destination.

Second, cost analysis is complicated by the problem of how to assign joint and common costs properly to the different services they support; for example, allocation of delivery route costs by class of mail.

Third, there is a problem in determining what costs are variable with volume changes over various time periods. Thus, some costs that appear fixed in the short run (e.g., 1 to 3 years) may be variable (i.e. adjustable to meet volume requirements) over a 10- or 20-year period.

On the revenue side, postal revenues depend on the volume of mail sent by customers in each of the many service categories established by USPS, and on the rates in each category. Revenue projections are further complicated by the need to consider the impact of inflation and public subsidies on rates, and in turn the impact of rates on mail volumes in each service category. There is a feedback process, but its exact nature is unknown. That is, changes in rates may have a significant effect on mail volume, which in turn affects mail rates 1, 2, or 3 years later (in the next rate-setting cycle).

In order to simplify the revenue/cost analysis for the purposes of this study, OTA developed a USPS revenue and cost model based on the following assumptions:

- *Percentage Fixed v. Variable Costs.* To the extent that a significant fraction of USPS costs are fixed, declining volumes would cause an increase in the average cost per piece of mail. This higher cost would have to be recovered by increases in rates or postal subsidies or offset by cost reductions through service cutbacks. OTA assumed a USPS fixed cost of about 36 percent based on the revenue and cost analysis used in the 1980 rate case before the Postal Rate Commission (PRC). The primary fixed costs were estimated by PRC to be $5.8 billion for USPS institutional costs (e.g., headquarters, postmasters, inspection service) and $1.8 billion for service-related fixed costs that could be assigned to various mail classes.[1]

- *Revenue and Cost Per Piece.* The 1980 PRC rate case was also used as the basis for determining revenue and variable cost per piece. For first-class mail, the per piece revenue and variable costs were 20¢ and 13¢, respectively.[2] The 20¢/piece revenue estimate assumed an 18¢ first-class stamp.
- *Economies of Scale.* OTA assumed that USPS is still operating with economies of scale, so that mail volume reductions would tend to increase the per piece cost of the remaining mail. If mail volumes reached or exceeded the optimal capacity of the system, then volume reductions might actually reduce rather than increase the per piece cost.
- *Inflation.* Clearly, inflation will cause postal costs to rise, and presumably rate increases will be necessary to keep up with inflation (to the extent that increased costs are not offset by improved productivity). For the purposes of this analysis, future revenues and costs are expressed in "constant dollars." Changes, too, are expressed in so-called "real" revenues or "real" costs—net of changes due to inflation.
- *Public Service Subsidy.* For the purposes of this analysis, the postal public service subsidy level was held constant at the $692 million level assumed by PRC in the 1980 rate case.[3] At the present time, there are no proposals to increase the subsidy; in fact, the Omnibus Budget and Reconciliation Act of 1981 has reduced the authority for such appropriations to zero by fiscal year 1984.
- *Productivity.* In terms of costs, any overall productivity improvements with respect to conventional mail were assumed to be offset by increases in the cost of capital and increases in real wages. Productivity gains due to the introduction of EMS were considered as part of the revenue/cost model for electronic mail.
- *Use of the Model.* By using the 1980 estimates of per piece first-class mail cost and applying this to future projections of USPS volumes for conventional first-class mail, future costs were calculated in 1980 dollars. Likewise, by using the 1980 estimate of per piece first-class revenue and applying this to projected mail volumes, future revenues were calculated in 1980 dollars.

---

[1] Postal Rate Commission, Opinion and Recommended Decision, docket No. R-80-1, p. 222.

[2] Ibid., app. G, schedule 1, p. 1.

[3] Ibid.

# USPS Revenue/Cost Model for First-Class Electronic Mail

In addition to a projected volume of conventional mail, USPS will deliver some volume of electronic mail (defined as Generation II EMS hardcopy). Thus, it was also necessary to develop revenue and cost assumptions for USPS electronic mail services. The cost consists of two parts: the cost for the USPS electronic portion of the system (including printing and enveloping), and the USPS mailstream cost of delivering the hardcopy.

For the mailstream portion, OTA assumed a cost displacement of 5¢/first-class piece, based on 1980 PRC estimates of the cost displacement for Mailgram.[4] That is, the mailstream cost of Generation II would be 8¢,

---

[4] Ibid; according to Frank Heselton, USPS Manager of Revenue and Cost Analysis, the 8¢/piece Mailgram cost includes only delivery and administrative costs. When the cost of operating Mailgram teleprinters is included, the per piece cost increases to about 24¢.

5¢/piece less than the mailstream cost of conventional mail. The 5¢/piece cost displacement is also reasonably consistent with estimates made by RCA for a USPS electronic system (specifically the electronic message service system (EMSS) concept).[5]

For the electronic portion, OTA did not independently verify either the RCA estimates for EMSS or the USPS estimates for electronic computer-originated mail (E-COM). Therefore, cost estimates were developed only for USPS delivery of Generation II first-class hardcopy output.

For average revenue per piece of Generation II EMS hardcopy output delivered, OTA assumed that the "markup" of per piece revenue over the per piece cost for EMS must be the same as the markup for the corresponding classes of conventional mail. Analysis of the 1980 PRC rate case indicated that the average per piece revenue level for first-class mail was roughly 50 percent higher than the per piece variable cost. This 1.50 factor was used to estimate a 12¢/piece revenue for USPS delivery of Generation II EMS hardcopy output.

# Results of the Revenue/Cost Analysis for First-Class Mail

Given the first-class mail volume projections from chapter 4 and using the revenue and cost models (for both conventional and USPS delivery of Generation II developed above), the financial impacts on USPS for first-class mail can be projected.

Figure 9 summarizes the results for the years 1995 and 2000 for each of the four Generation II EMS alternatives under the baseline assumptions (2-percent underlying mailstream growth). The results are also shown for each alternative under the alternative revenue/cost assumption alone and in combination with the 100-percent EMS stimulation assumption.

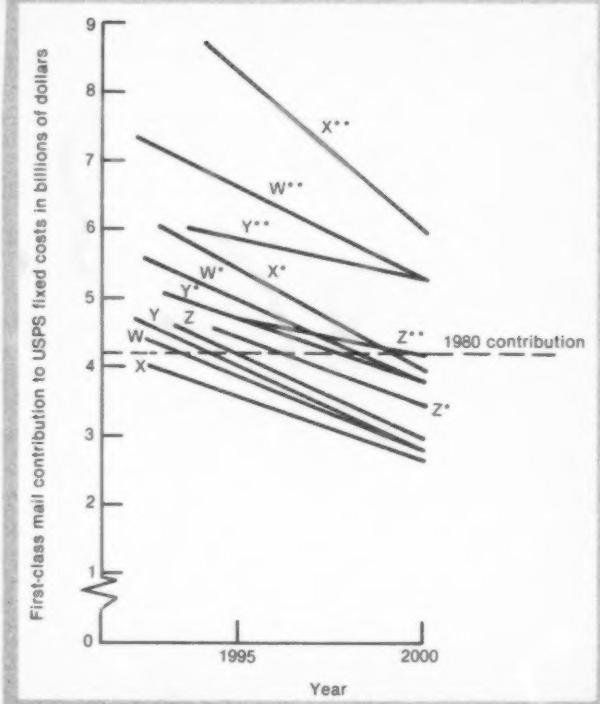
The tabular data in figure 9 gives the mail volumes for conventional first-class and Generation II EMS first-class with USPS delivery of industry hardcopy output. The revenues and costs for these volumes are indicated along with the contribution of each to USPS fixed costs. USPS is not allowed to make a profit overall, but individual classes and subclasses of mail do make varying contributions to fixed costs. First-class mail historically has made the largest contribution of any class of mail, and thus the continuing ability of first-class mail volumes to generate a substantial contribution appears to be very important to overall USPS financial stability. In fiscal year 1980, the first-class mail contribution to USPS fixed costs was about $4.2 billion, based on an actual volume of 60 billion pieces and assuming 20¢/piece revenue and 13¢/piece variable cost.

Basically, the results indicate that by 2000, for the baseline assumptions, USPS-delivered first-class mail is projected to contribute between $1.25 billion (for the slow Generation II EMS growth alternative) to about $1.5 billion (for the very high, high, and moderate growth alternatives) *less* to USPS fixed costs than in fiscal year 1980. Thus, in 2000, for the high but plausible Generation II EMS growth alternative, the first-class mail contribution is projected to be about $2.76 billion, which is $1.44 billion less than the contribution in 1980. If a 3-percent underlying mailstream rate is assumed, in 2000 the net reduction in first-class mail contribution for the high but plausible growth alternative would be less but still significant. As shown in figure 10, under the 3-percent growth assumption, the first-class mail contribution is projected at $3.46 billion, which is about $750 million below the 1980 contribution. With a 1-percent underlying mailstream growth, the first class mail

---

[5] RCA Government Communications Systems Division, *EMSS System Analysis Task AB, Vol. II, Cost and Service Impact of System Decentralization,* October 1977.

**Figure 9.—Contribution of USPS-Delivered First-Class Mail (conventional plus Generation II EMS) to USPS Fixed Costs (assuming 2% underlying mailstream growth)**

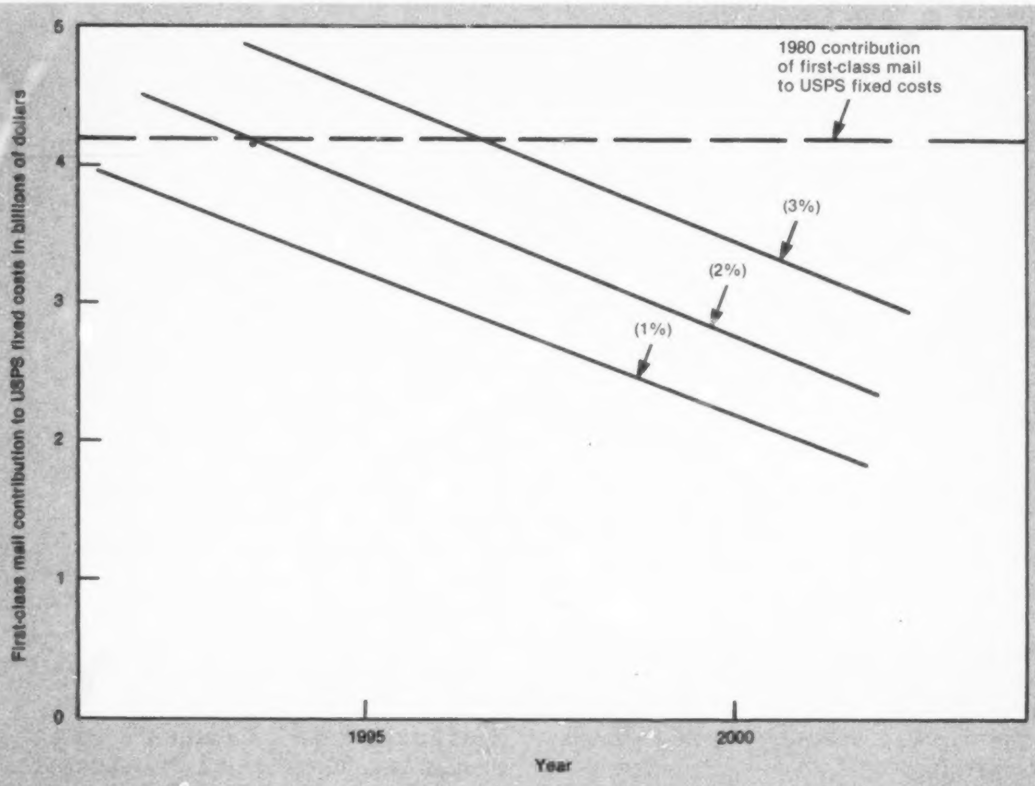


NOTES: W = High but plausible Generation II EMS growth alternative under baseline assumptions
X = Very high growth alternative
Y = Moderate growth alternative
Z = Slow growth alternative
* = Assumes alternative revenue/cost figures
** = Assumes alternative revenue/cost figures and 100% EMS stimulation

| | 1995 EMS growth alternative | | | | 2000 EMS growth alternative | | | |
|---|---|---|---|---|---|---|---|---|
| | High | Very high | Moderate | Slow | High | Very high | Moderate | Slow |
| Conventional first-class with 20¢/piece revenue, 13¢/piece cost. | | | | | | | | |
| Volume (billions of pieces) | 47.15 | 37.78 | 51.30 | 57.89 | 32.37 | 28.28 | 32.50 | 38.78 |
| Revenue ($ billions) | 9.43 | 7.56 | 10.27 | 11.58 | 6.47 | 5.66 | 6.50 | 7.76 |
| Variable cost ($ billions) | 6.13 | 4.91 | 6.68 | 7.53 | 4.21 | 3.68 | 4.23 | 5.04 |
| Contribution to fixed costs ($ billions) | 3.30 | 2.64 | 3.59 | 4.05 | 2.26 | 1.98 | 2.27 | 2.72 |
| Generation II EMS first-class with 12¢/piece revenue, 8¢/piece cost | | | | | | | | |
| Volume | 13.64 | 23.02 | 9.43 | 2.90 | 12.51 | 16.60 | 12.37 | 6.08 |
| Revenue | 1.64 | 2.76 | 1.13 | 0.35 | 1.50 | 1.99 | 1.48 | 0.73 |
| Variable cost | 1.09 | 1.84 | 0.75 | 0.23 | 1.00 | 1.33 | 0.99 | 0.49 |
| Contribution | 0.55 | 0.92 | 0.38 | 0.12 | 0.50 | 0.66 | 0.49 | 0.24 |
| Total first-class mail contribution to fixed costs | 3.85 | 3.56 | 3.97 | 4.17 | 2.76 | 2.64 | 2.76 | 2.96 |
| Generation II with 20¢/piece revenue, 8¢/piece cost | | | | | | | | |
| Volume | 13.64 | 23.02 | 9.43 | 2.90 | 12.51 | 16.60 | 12.37 | 6.08 |
| Revenue | 2.73 | 4.60 | 1.89 | 0.58 | 2.50 | 3.32 | 2.47 | 1.22 |
| Variable cost | 1.09 | 1.84 | 0.75 | 0.23 | 1.00 | 1.33 | 0.99 | 0.49 |
| Contribution | 1.64 | 2.76 | 1.14 | 0.35 | 1.50 | 1.99 | 1.48 | 0.73 |
| Total first-class mail contribution | 4.94 | 5.40 | 4.73 | 4.40 | 3.76 | 3.97 | 3.75 | 3.45 |
| Generation II with 20¢/piece revenue, 8¢/piece cost plus 100% EMS stimulation | | | | | | | | |
| Volume | 27.27 | 46.05 | 18.87 | 5.80 | 25.01 | 33.20 | 24.75 | 12.18 |
| Revenue | 5.45 | 9.21 | 3.77 | 1.16 | 5.00 | 6.64 | 4.95 | 2.44 |
| Variable cost | 2.18 | 3.68 | 1.51 | 0.46 | 2.00 | 2.66 | 1.98 | 0.97 |
| Contribution | 3.27 | 5.53 | 2.26 | 0.70 | 3.00 | 3.98 | 2.97 | 1.47 |
| Total first-class mail contribution | 6.57 | 8.17 | 5.85 | 4.75 | 5.26 | 5.96 | 5.24 | 4.19 |

SOURCE: Office of Technology Assessment.

**Figure 10.—Contribution of USPS-Delivered First-Class Mail to USPS Fixed Costs for High But Plausible Generation II Growth Alternative (assuming 1%, 2%, and 3% underlying mailstream growth)**



| | 1995 | | | 2000 | | |
|---|---|---|---|---|---|---|
| | 1% | 2% | 3% | 1% | 2% | 3% |
| Conventional first-class with 20¢/piece revenue, 13¢/piece cost | | | | | | |
| Volume (billions of pieces) | 39.49 | 47.15 | 56.20 | 25.81 | 32.37 | 40.51 |
| Revenue ($ billions) | 7.90 | 9.43 | 11.24 | 5.16 | 6.47 | 8.10 |
| Variable cost ($ billions) | 5.13 | 6.13 | 7.31 | 3.36 | 4.21 | 5.27 |
| Contribution to fixed costs ($ billions) | 2.77 | 3.30 | 3.93 | 1.80 | 2.26 | 2.83 |
| Generation II EMS first-class with 12¢/piece revenue, 8¢/piece cost | | | | | | |
| Volume | 11.42 | 13.64 | 14.78 | 9.98 | 12.51 | 15.65 |
| Revenue | 1.37 | 1.64 | 1.77 | 1.20 | 1.50 | 1.88 |
| Variable cost | 0.91 | 1.09 | 1.18 | 0.80 | 1.00 | 1.25 |
| Contribution | 0.46 | 0.55 | 0.59 | 0.40 | 0.50 | 0.63 |
| Total first-class contribution to fixed costs | 3.23 | 3.85 | 4.52 | 2.20 | 2.76 | 3.46 |

SOURCE: Office of Technology Assessment.

contribution would be $2.2 billion, a full $2 billion below the 1980 level.

How significant is a $0.75 billion, $1.25 billion, or $1.50 billion reduction in first-class mail contribution to USPS fixed costs? It would appear to be quite significant considering that the total public appropriation (public service subsidy plus revenue forgone) to USPS for fiscal year 1980 was about $1.6 billion. The fiscal year 1980 revenue forgone appropriation (to offset revenue losses from mail service provided at reduced rates, primarily nonprofit second-class mail, nonprofit bulk rate third-class mail, library materials, and free mail for the blind and handicapped) alone was $0.782 billion. And the incremental cost of delivery 6 days per week compared to 5 has been estimated by USPS to be about $0.65 billion.

In other words, the projected reduction in first-class mail contribution in 2000 is roughly equivalent, under the baseline assumptions, to the combined 1980 public service and revenue forgone appropriation, or to the revenue forgone appropriation plus the cost of Saturday delivery, or the equivalent. Under the 3-percent mailstream growth assumption, the reduction in first-class mail contribution is roughly equivalent to the 1980 public service subsidy, or the revenue forgone appropriation, or the cost of Saturday delivery.

In general, as long as Generation II first class costs less per piece than conventional first class but has the same markup of revenue over cost per piece (50 percent), the first-class mail contribution to USPS fixed costs will decline as Generation II volume increases (assuming Generation II EMS costs USPS less than conventional.) Thus, as indicated in figure 9, the first-class contribution is greater for the slow Generation II EMS growth alternative than for the high or very high growth alternatives.

The financial contribution of Generation II EMS could be increased if the rate for USPS delivery of EMS hardcopy output were the same as the rate for conventional mail delivery. Up to this point in the analysis, OTA assumed that all cost savings from EMS would be passed on directly to the EMS user (i.e., whoever is paying the postage). Thus, the relationship between EMS first-class mail per piece revenue and cost was assumed to be the same as for conventional first-class mail. In other words, cost savings from EMS were reflected in lower EMS rates rather than in lower rates for other classes of mail or the mailstream as a whole. As a result, USPS could not obtain any greater return ("markup" or contribution to fixed costs) from EMS than from conventional mail.

Under the alternative revenue/cost assumption tested by OTA, EMS first-class rates were assumed to be the same as conventional first-class mail rates. In this scenario, USPS would, in effect, be pricing Generation II EMS first-class mail to contribute a higher percentage (or markup) to fixed costs than would conventional mail. Thus, a revenue per piece of 20¢ was used for EMS instead of 12¢. As shown in figure 9, when using the alternative revenue/cost assumption, the high, very high, or moderate growth alternatives would result in an additional first-class mail contribution of roughly $1 billion in 2000 (compared to the projected contribution under the baseline assumptions). This level would still be a few hundred million dollars below the current first-class mail contribution to fixed costs. Note that the analysis also assumed no loss in EMS volume due to the higher USPS rates. If EMS users were sensitive to the increase from 12 to 20¢/piece (for USPS delivery of Generation II hardcopy output), then the increased revenue from higher rates might be offset by reduced revenue from lower volume.

If 100-percent EMS stimulation is also assumed (each Generation II message stimulates an additional new message), the first-class mail contribution to fixed costs in 2000 would be significantly higher than the 1980 contribution, by as much as $1 billion for the high and moderate growth alternatives and $1.5 billion for the very high growth alternative. These projections are included in figure 9. This scenario would enable USPS to use net revenues from Generation II EMS to help keep down overall rates for conventional mail, even in the face of the declining conventional mail volumes projected for 2000. However, as noted in chapter 5, the 100-percent EMS stimulation assumption is considered speculative at this time.

Under current USPS pricing policies, to the extent that private firms transmit Generation II messages and present them to USPS for local delivery, these messages will be delivered as first-class mail at the same rates as for conventional mail. Thus, the alternative revenue/cost assumption would apply, and the contribution to USPS fixed costs would be 12¢/piece rather than 4¢. To the extent that USPS provides electronic services (e.g., printing, enveloping, and/or transmission) as well as physical processing and delivery. USPS would establish rates to cover the costs of electronic services plus some markup over costs. This would provide an additional contribution to fixed costs. OTA has not estimated or analyzed this contribution.

Chapter 6

# Implications for Postal Rates, Service Levels, and Labor Requirements

# Contents

Page

Introduction . . . 61

Postal Rates . . . 61

Service Levels . . . 63

Labor Requirements . . . 64

## TABLES

*Table No.* *Page*

10. Projected First-Class Mail Rate Increases or Decreases, Years 1995 and 2000 . . . 62
11. USPS Service Levels, Fiscal Year 1980 . . . 63
12. Structure of the USPS Labor Force, Fiscal Year 1980 . . . 65
13. Changes in USPS Labor Force Requirements for High But Plausible Generation II EMS Growth Alternative, Year 2000, As a Function of Underlying Mailstream Growth Rate and Labor Productivity Improvement per Year . . . 68
14. Projected USPS Year 2000 Labor Force Requirements by Employee Group, Assuming High But Plausible Generation II EMS Growth, 2-Percent Underlying Mailstream Growth, and 1.5-Percent Labor Productivity Improvement . . . 68
15. Projected USPS Year 2000 Labor Force Requirements by Employee Group, Assuming High But Plausible Generation II EMS Growth, 2-Percent Underlying Mailstream Growth, and 3-Percent Labor Productivity Improvement . . . 69
16. Projected Year 2000 USPS Labor Force Reductions Assuming 2-Percent Underlying Mailstream Growth and 1.5-Percent Productivity Improvement . . . 70

## FIGURE

*Figure No.* *Page*

11. Sensitivity Analyses of Projected Changes in USPS Labor Force Requirements for 1995 and 2000 Assuming High But Plausible Generation II EMS Growth and 1.5-Percent Annual Labor Productivity Improvement . . . 67

## Chapter 6

# Implications for Postal Rates, Service Levels, and Labor Requirements

## Introduction

Postal rates, service levels, and labor requirements are integrally related. By law, the U.S. Postal Service (USPS) is required to achieve break-even operations; that is, revenues should equal costs as nearly as possible. Thus, postal rates are established at the levels needed to generate revenues sufficient to cover projected costs over a given period of time (2 to 3 years in a typical ratesetting cycle). The projected costs are based on assumptions about USPS mail volumes and service levels. The major cost component is labor, which in fiscal year 1980 accounted for about 85 percent of total USPS costs.[1] For the current level of service, about 60 percent of labor costs are fixed; that is, are required to maintain the service level regardless of variations in mail volume.[2]

---

[1] *Annual Report of the Postmaster General*, fiscal 1980, p. 24.

[2] USPS fiscal year 1980 Revenue and Cost Analysis; also see Robert W. Anthony, et al., *Strategy for Decisions: American Postal Workers Union and the Electronic Information Revolution*, The George Washington University Program of Policy Science and Technology, Washington, D.C., Mar. 1, 1980, pp. 55-56.

## Postal Rates

While OTA was not able to do a revenue/cost analysis for all classes of mail, the results of the analysis for first-class mail suggest that under the baseline high but plausible Generation II electronic mail and message system (EMS) growth alternative, postal rates would have to increase in constant dollars (net of inflation) after 1995, assuming service levels were not reduced. As shown earlier in figure 4 (based on the market penetration analysis), the breakdown of mail by class for the high but plausible Generation II EMS growth alternative indicates that through the early 1990's the split between first-class mail and other classes would be roughly the same as in 1980. Reductions in conventional first-class mail would be largely offset by increases in Generation II EMS hardcopy output delivered by USPS.

However, by 1995 the net reduction in total USPS-delivered first-class mail would, for the baseline high growth alternative, require a small rate increase to maintain the first-class mail contribution to USPS fixed costs, based on the chapter 5 revenue/cost analysis (see figs. 9 and 10). By 2000, the required rate increase could be more substantial, on the order of 18 percent. If the underlying mailstream growth turned out to be 1 percent rather than 2 percent, a rate increase of more than 30 percent might become necessary. On the other hand, for a 3-percent underlying mailstream growth, the required rate increase in 2000 would be about 7 percent. For illustrative purposes, an 18-percent increase in first-class mail rates would translate roughly into an increase of 3.5¢/piece in the conventional first-class mail rate and a 1.5¢/piece increase in the rate for delivery of Generation II EMS first class. These rate increases would recover the projected $1.5 billion shortfall in first-class mail contribution to fixed costs in 2000 for the baseline high growth alternative.

Projected rate increases (or decreases) under various assumptions are summarized in table 10. As shown, using the alternative/revenue cost assumption (where revenue/piece is the same for conventional and Generation II hardcopy first-class delivery, as would be the case under current USPS pricing policies), a small rate decrease is projected for 1995. If the 100-percent EMS stimulation assumption also applied, for the high Generation II growth alternative, rate decreases of about 16 and 9 percent are projected for 1995 and 2000, respectively. Under these assumptions, the projected rate decreases are even larger for the alternative representing very high Generation II EMS growth. Even the slow growth alternative would not require a rate increase in 2000.

**Table 10.—Projected First-Class Mail Rate Increases or Decreases, Years 1995 and 2000**

| | 1995 | 2000 |
|---|---|---|
| ***High but plausible Generation II EMS growth alternative*** | | |
| Underlying mailstream growth rate 1 percent | + 10.5% | + 31.4% |
| Underlying mailstream growth rate 2 percent | + 3.2 | + 18.1 |
| Underlying mailstream growth rate 3 percent | – 2.5 | + 7.4 |
| Assume alternative revenue/cost figures | – 6.1 | + 4.9 |
| Assume alternative revenue/cost figures and 100 percent EMS stimulation | – 15.9 | – 9.2 |
| ***Very high Generation II EMS growth alternative*** | | |
| Underlying mailstream growth rate 2 percent | + 6.2 | + 20.4 |
| Assume alternative revenue/cost figures | – 9.9 | + 2.6 |
| Assume alternative revenue/cost figures and 100 percent EMS stimulation | – 23.7 | – 14.3 |
| ***Moderate Generation II EMS growth alternative*** | | |
| Underlying mailstream growth rate 2 percent | + 2.0 | + 18.1 |
| Assume alternative revenue/cost figures | – 4.4 | + 5.0 |
| Assume alternative revenue/cost figures and 100 percent EMS stimulation | —11.8 | – 9.1 |
| ***Slow Generation II EMS growth alternative*** | | |
| Underlying mailstream growth rate 2 percent | + 0.3 | + 14.6 |
| Assume alternative revenue/cost figures | – 1.6 | + 8.4 |
| Assume alternative revenue/cost figures and 100 percent EMS stimulation | – 4.3 | + 0.1 |

(+) = projected first-class mail rate increase
(–) = projected first-class mail rate decrease
Unless otherwise indicated, 2-percent underlying mailstream growth rate is assumed.

SOURCE: Office of Technology Assessment; based on data from figs. 9 and 10.

In comments to OTA, the Department of Justice (DOJ) has expressed the view that USPS could not successfully charge a different rate for delivery of Generation II as compared to conventional first-class mail, either legally under the Postal Reorganization Act's ratesetting requirements or as a practical operational matter. Both the Postal Rate Commission and DOJ reviewers believe that OTA's alternative revenue/cost assumption is the most likely rate basis, absent a change in USPS pricing policies.

All of the foregoing projections assume other variables are held constant, including volume. If first-class volume was sensitive to rate increases, a volume reduction could result which might in turn necessitate further rate increases, and so on. A 20- to 30-percent increase (net of inflation) in first-class rates could be enough to adversely affect the competitive position of first-class mail. If second- and third-class volumes declined significantly, perhaps due to competition from alternative delivery services, additional pressure on rates would be generated. Also, all of the rate projections are in constant 1980 dollars and do not reflect increases due to inflation. And the revenue/cost analysis in chapter 5 assumed that productivity improvements with respect to conventional mail would offset increases in the cost of capital and real wages. Should the real cost of capital or labor or both exceed the inflation rate, further upward pressure on postal rates would be experienced. In addition, the revenue/cost analysis assumed significant cost displacement for USPS delivery of Generation II EMS hardcopy output. If the cost displacement turned out to be less, or if other kinds of USPS EMS services resulted in a net real cost increase, the rate projections could be substantially different. Finally, the revenue/cost analysis assumed that current USPS service levels would be maintained.

However, USPS could choose to reduce service levels and labor requirements rather than increase rates in the face of declining USPS-delivered mail volume.

## Service Levels

Based on projected mail volumes for the baseline high Generation II growth alternative, it appears that USPS might have to reduce current service levels significantly after 1995 in order to avoid real rate increases. After that time, the shortfall in the first-class mail contribution to USPS fixed costs could become large enough to warrant consideration of service cutbacks rather than rate increases, particularly if rate increases would further reduce USPS mail volume. On the other hand, if the alternative revenue/cost assumption held up, and if Generation II EMS could contribute significantly more per piece to USPS fixed costs than could conventional mail, then major real rate increases (net of inflation) or service cutbacks could be forestalled until past 2000. This would also be the case if the underlying mailstream growth was 3 percent rather than 2 percent.

Present USPS service levels are summarized in table 11. Since the USPS commenced operations on July 1, 1971, the number of days of delivery per week has remained the same. The number of post offices, branches, and stations has declined at a very slow rate. For example, over the last 5 years, the number of post offices declined at a rate of 1.4 percent per year.[3] In contrast, the number of city delivery points has increased by about 21 percent since 1971, and the number of rural delivery points by about 50 percent.[4] Since USPS is obligated by law to provide mail service to all business and residential addresses in the United States, the number of delivery points has expanded along with growth in population and in populated areas. USPS has instituted some measures, such as the use of cluster mailboxes, to limit the increase of delivery points in newly populated areas such as suburban or exurban residential developments.

**Table 11.—USPS Service Levels, Fiscal Year 1980**

| Service criteria | Level of service |
|---|---|
| Days of delivery per week | 6 |
| Number of post offices | 30,326 |
| Number of branches and stations | 9,160 |
| Number of city delivery points | 68.5 million |
| Number of rural delivery points | 14.7 million |
| Overnight delivery of local area mail | 95 percent on time |
| 2-day delivery of 600-mile radius mail | 86 percent on time |
| 3-day delivery of cross-country mail | 87 percent on time |

SOURCE: *Annual Report of the Postmaster General, Fiscal 1980*, pp. 10, 11, 31.

While OTA did not study USPS service levels in detail, there is some evidence to suggest that the mail system is nearing capacity. In other words, there may be limits to the volume of conventional mail that can be handled without sacrificing quality of service. For example, a USPS task force concluded that 5-day delivery "would have a negative impact on service, including overtime, inconsistent delivery, delayed deliveries, equipment shortages, inadequate space to store accumulated mail, and inadequate vehicle capacity."[5] Also, since 1977 when total mail volume reached about 92 billion pieces, first-class mail delivery performance has declined for all but local area mail. Ontime (overnight) delivery for local area mail has remained quite stable at about 95 percent, but ontime delivery (2-day) for 600 mile radius mail has decreased from 90 to 86 percent since 1977. Ontime (3-day) delivery for cross-country mail has dropped from about 91 to 87 percent.[6] The long-term performance trends since 1973, the year when comparable delivery data first were collected, indicate that possibly USPS has reached its peak in terms of improvement in national delivery performance with the current mail system.[7] While performance is dropping off (for other than local area first-class mail), delivery work hours are creeping up again after declining for many years. More specifically, delivery work hours decreased by about 8 percent from 1970 to 1978 while total USPS delivery points increased by 20 percent during that period. But since 1978, delivery work hours have increased by about 4 percent while delivery points rose by 6 or 7 percent.[8]

---

[3] *Annual Report of the Postmaster General*, fiscal 1980, p. 31 and *Annual Report of the Postmaster General*, fiscal 1979, p. 31.

[4] *Annual Report of the Postmaster General*, fiscal 1980, p. 10.

[5] U.S. General Accounting Office, *Implications of Electronic Mail for the Postal Service's Work Force*, Feb. 6, 1981, pp. 34-35.

[6] *Annual Report of the Postmaster General*, fiscal 1980, p. 11.

EMS have several implications for USPS service levels. On the one hand, the projected reductions in USPS-delivered first-class mail for the baseline high Generation II EMS growth alternative would reduce the year 2000 first-class contribution to USPS fixed costs by about $1.5 billion and, in turn, could translate into $1.5 billion worth of service reductions in order to avoid rate increases. OTA did not analyze in detail what kinds of service cuts would save $1.5 billion. However, USPS officials have estimated that delivery 5 days a week would save about $650 million (1980 dollars). A 1975 General Accounting Office study estimated that closing 12,000 small and rural post offices would save $100 million (1975 dollars),[9] and a 1976 congressional study projected a saving of $1.1 billion (1977 dollars) for delivery 3 days a week.[10] Any of these service changes undoubtedly would be controversial.

On the other hand, Generation II EMS service could help to improve USPS performance. To the extent that excessive mail delays now occur in processing and sorting the large volumes of conventional mail, Generation II EMS could help to relieve these strains since Generation II would bypass many of the processing and sorting steps now required. Presumably, Generation II EMS would also speed up delivery of mail sent outside the local area since electronic transmission would be much faster than physical transport. A fully deployed nationwide Generation II EMS service could reasonably be expected to provide 1-day delivery nationwide 95 percent of the time. Cost savings associated with the reduced sorting, processing, and transportation requirements of Generation II EMS were reflected in the 5¢/piece cost displacement (compared to conventional mail) assumed in the revenue/cost analysis (ch. 5).

Finally, if Generation II EMS volume was higher than the baseline and/or if Generation II EMS made a greater per piece contribution to USPS fixed costs than conventional mail, then Generation II EMS could generate enough revenue to offset the need for service cutbacks and would contribute to improved USPS performance at current service levels.

Even if service cutbacks became necessary, Generation II EMS could help USPS maintain service to particular geographic areas or types of customers where full service conventional mail might be considered too expensive or no longer cost effective. For example, location of Generation II EMS terminals in smaller or more remote post offices could reduce or eliminate long distance transportation costs that might become prohibitively high, forcing the closure of such offices.

## Labor Requirements

USPS is a labor-intensive organization. As noted earlier, labor represents about 85 percent of total USPS costs. Labor requirements are primarily determined by three factors—USPS service levels, labor productivity, and mail volumes. By making assumptions about service levels and labor productivity, it is possible to estimate the labor requirements for projected future mail volumes.

---

[7] Ibid.

[8] Ibid., p. 12.

[9] Comptroller General of the United States, *$100 Million Could Be Saved Annually in Postal Operations in Rural America*, Washington, D.C., U.S. General Accounting Office, 1975.

[10] U.S., Congress, House Committee on Post Office and Civil Service, *The Necessity for Change*, 94th Cong., 2d sess., Dec. 10, 1976, p. 40.

As a first step in the analysis, OTA estimated variable and fixed percentages for each major group of USPS employees. The results are summarized in table 12, along with the total number of employees in each group as of fiscal year 1980. The variable percentage is the labor component that varies directly with mail volume. The fixed percentage is the labor component that is necessary to maintain the current service levels. The variable and fixed percentages in table 12 were derived by OTA directly from the USPS fiscal year 1980 Revenue and Cost Analysis. The variable labor percentage is based on the direct and indirect variable attributable cost from the USPS analysis, expressed as a percentage of total accrued costs. The fixed labor percentage is the sum of specific fixed attributable costs plus all other institutional costs for each employee group. The variable and fixed labor percentages were reviewed with USPS and found to be reasonable.

Table 12.—Structure of the USPS Labor Force, Fiscal Year 1980

| Employee group[a] | Number of employees[b] | Variable percentage[c] | Fixed percentage[c] |
|---|---|---|---|
| Headquarters employees | 2,798 | 0 | 100% |
| Regional and other field units | 6,228 | 0 | 100 |
| Inspection service | 5,242 | 0 | 100 |
| Postmasters | 28,967 | 19% | 81 |
| Post office supervisors and technical personnel | 36,481 | 52 | 48 |
| Subtotal | 79,716 | | |
| Post office clerks and mail handlers | 303,560 | 86 | 14 |
| City delivery carriers and vehicle drivers | 193,730 | 50 | 50 |
| Rural delivery carriers | 53,069 | 27 | 73 |
| Special delivery messengers | 2,502 | 39 | 61 |
| Building and equipment maintenance personnel | 29,409 | 45 | 55 |
| Vehicle maintenance facility personnel | 4,837 | 29 | 71 |
| Total | 666,823 | 61% | 39% |

[a] Includes full- and part-time employees.

[b] Based on *Annual Report of the Postmaster General, Fiscal 1980*, p. 31, and data supplied by F. L. Ben Kinney, USPS Manager of Financial Planning.

[c] Based on USPS, *FY80 Revenue and Cost Analysis, Cost Segments and Components Workpaper*, pp. 7-82.

SOURCE: Office of Technology Assessment.

The overall cost split for the entire USPS labor force was calculated to be 61 percent variable and 39 percent fixed. This fixed percentage is somewhat higher than the 36 percent fixed for total USPS costs used in the OTA revenue/cost analysis (ch. 5). The 36 percent reflects the lower fixed percentages of the cost components for transportation (primarily air, rail, and highway) and building occupancy (rents, fuel, and utilities). The 61/39 split for labor is reasonably consistent with actual data on the relationship between USPS labor work hours and mail volume changes collected during 1979 and 1980.[11]

As a next step, OTA calculated labor productivity index values at 5-year intervals from 1980 to 2000. An average productivity improvement of 1.5 percent per year was assumed as the baseline. USPS labor productivity improved by roughly 3 percent annually during the 1970's, and a goal of 3 percent improvement per year has been announced. But this does not appear to be realistic in view of the fact that most productivity improvement from automation and mechanization has already been realized. Even the expanded ZIP code program, known as ZIP + 4, would realize a cumulative labor productivity improvement of only 2.3 percent, according to USPS estimates.[12] For comparison purposes, labor force requirements were also calculated for 3.0- and 0.0-percent productivity improvement per year.

Employee groups with 100 percent fixed costs would not vary with mail volume. A total of only 14,268 employees, or about 2.1 percent of the total USPS labor force, fall into this category. Included here would be headquarters, regional, and inspection service employees. This assumes that current service levels are maintained. If, for example, a significant number of major post offices were closed, then some portion of the costs for these employee groups would become variable. In this case, the fixed percentage for postmasters would be lower than the 81 percent shown in table 12.

---

[11] Robert W. Anthony, et al., op. cit., pp. 55-56.

[12] See ch. 2, footnote 4.

Costs for the 303,560 clerks and mail handlers (full- and part-time) would vary significantly with conventional mail volume. The clerks and mail handlers represent the one employee group with very limited participation in a Generation II EMS service. Generation II would bypass many of the traditional mail sorting and processing functions performed by clerks and handlers, but would still require physical delivery (whether by city or rural carriers). The cost split for the clerks and mail handlers is 86 percent variable/14 percent fixed. Most other employee groups would vary significantly with total USPS-delivered mail volume (conventional plus Generation II EMS). This would include supervisory, maintenance, and technical personnel plus the city, rural, and special delivery employees. A total of 320,028 employees, or about 48 percent of the total USPS labor force, are in this category. This includes part-time and casual employees who function in part to help the USPS accommodate to fluctuations in mail volume, for example, at peak holiday mailing periods.

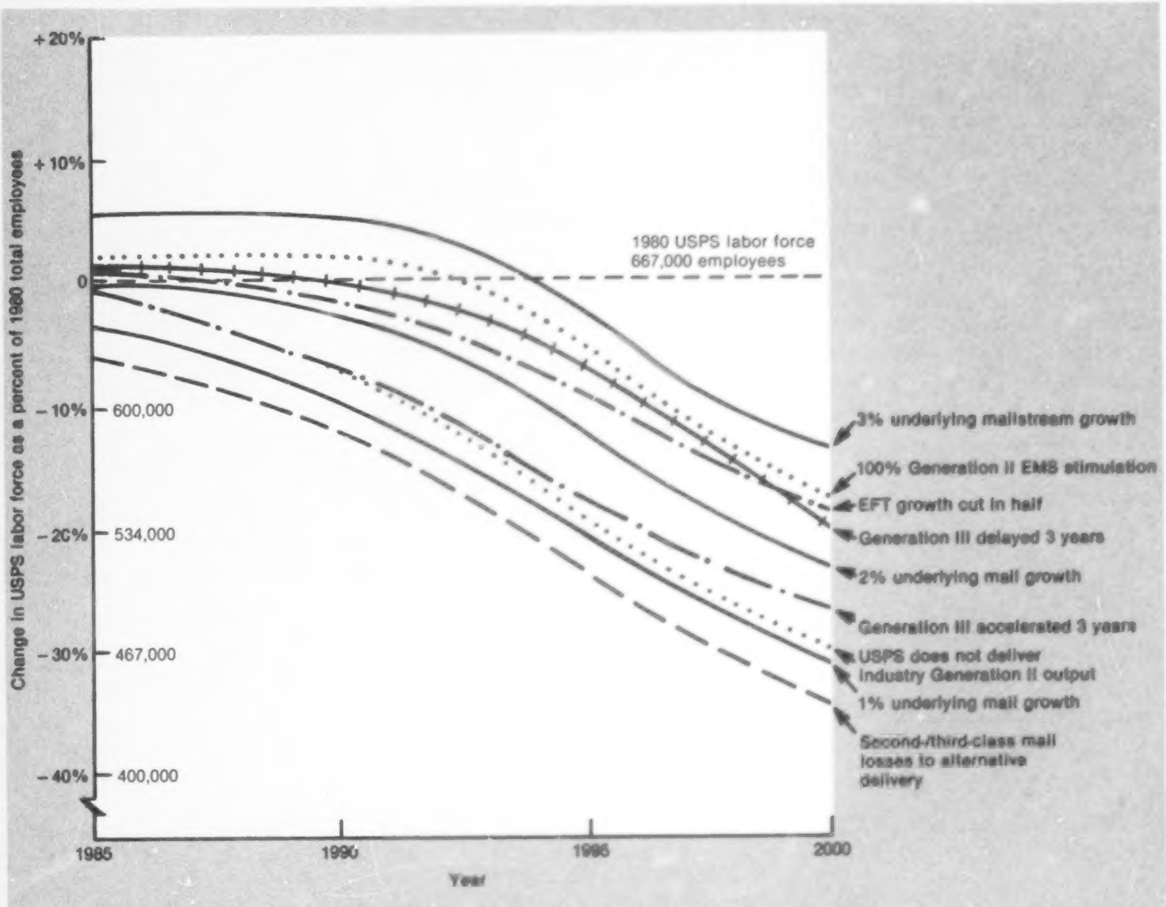
The equation used by OTA to calculate labor requirements, given the variable labor cost, labor productivity, and projected mail volume, is provided in appendix C. In order to simplify this analysis, clerks and mail handlers were assumed to vary with total USPS-delivered mail volume, not just with conventional mail. This will tend to understate the projected change in requirements for clerks and mail handlers and in the total USPS labor force.

Figure 11 presents the projected overall USPS labor force changes for the years 1985, 1990, 1995, and 2000 under the baseline high but plausible Generation II EMS growth alternative, and assuming 1.5-percent annual labor productivity improvement. The projected increase or decrease, expressed as a percentage change in the total USPS labor force, is shown for each of the various sensitivity assumptions used in chapter 4 to develop the USPS-delivered mail volumes on which the labor requirement calculations are based. (See fig. 7 for the corresponding mail volume projections.) The projected labor force reduction ranges from 2.7 to 22.8 percent in 1995, and from 13.8 to 34.3 percent in 2000. The base case (assuming 2-percent underlying mailstream growth) falls roughly in the middle of the range, with a 12.2-percent labor force reduction projected for 1995 and a 23.3-percent reduction projected for 2000.

For the base case, this translates into a reduction of 81,352 employees by 1995 and 155,370 employees by 2000. By comparison, between 1971 and 1980 the USPS labor force declined by roughly 65,000 employees. Thus, the projected rate of reduction under the base case (high but plausible Generation II EMS growth, 2-percent underlying mailstream growth, 1.5 percent per year labor productivity improvement) over the next two decades would be higher than the rate of reduction experienced during the last decade. However, as shown in figure 11, if the underlying mailstream growth is 3 percent rather than 2 percent, the labor force reduction in 2000 would be 13.8 percent or 92,022—significantly less than the rate of reduction experienced in the 1970's. On the other hand, if the underlying mailstream growth rate turned out to be 1 percent or if USPS did not deliver industry Generation II hardcopy output, the labor force reduction would be about 30 percent, which translates into 200,000 employees.

Of course, if 3-percent-per-year labor productivity improvement is assumed, the projected labor force reductions would be even higher or, if zero labor productivity improvement is assumed, labor force reductions would be lower. The sensitivity of labor force requirements to both labor productivity improvement and underlying mailstream growth rate is illustrated in table 13 for the high Generation II growth alternative. As shown, with 3-percent annual growth in the underlying mailstream and a zero-percent annual labor productivity improvement, no reduction—and indeed a small increase—in the labor force requirement is projected for 2000. At the other extreme, with 1-percent underlying mail-

**Figure 11.—Sensitivity Analyses of Projected Changes in USPS Labor Force Requirements for 1995 and 2000 Assuming High But Plausible Generation II EMS Growth and 1.5-Percent Annual Labor Productivity Improvement**



| Sensitivity assumptions (assume 2% underlying mailstream growth unless otherwise indicated) | Change in USPS labor force (percent of 1980 total employees) | | | |
|---|---|---|---|---|
| | 1985 | 1990 | 1995 | 2000 |
| 3% growth in underlying mailstream | +5.7 | +5.6 | -2.7 | -13.8 |
| 100% stimulation of additional Generation II EMS | +2.0 | +2.1 | -5.0 | -17.7 |
| EFT growth rates cut in half | +0.7 | -1.5 | -9.4 | -18.3 |
| Generation III EMS delayed by 3 years | +1.4 | +0.1 | -6.6 | -18.9 |
| 2% growth in underlying mailstream | +0.6 | -2.4 | -12.2 | -23.3 |
| Generation III EMS accelerated by 3 years | -0.8 | -6.8 | -17.6 | -26.7 |
| USPS does not deliver industry Generation II | -0.7 | -6.8 | -19.2 | -29.0 |
| 1% growth in underlying mailstream | -3.7 | -9.4 | -20.1 | -30.9 |
| Second-/third-class mail diversion to alternative delivery | -6.0 | -12.2 | -22.8 | -34.3 |

SOURCE: Office of Technology Assessment.

stream growth and 3-percent productivity improvement, a very substantial 38.6-percent reduction in labor force is projected in 2000. However, only about half of this reduction would be due to declining mailstream volume, with the other half due to labor productivity improvement.

Labor requirements could be calculated for every separate employee group under various assumptions in any future year specified. OTA estimated detailed labor force requirements in 2000 for the base case (high but plausible Generation II EMS growth alternative, 2-percent underlying mailstream growth, 1.5-percent labor productivity growth) and for the base case modified to assume a 3-percent annual labor productivity improvement. Actually, as indicated in table 13, in terms of overall projected labor force changes, the base case is roughly the same as the 1-percent mailstream/0-percent labor productivity and 3-percent mailstream/3-percent labor combinations. The 2-percent mailstream/3-percent labor productivity is about the same as the 1-percent mailstream/1.5-percent labor productivity combination.

**Table 13.—Changes in USPS Labor Force Requirements for High But Plausible Generation II EMS Growth Alternative, Year 2000, As a Function of Underlying Mailstream Growth Rate and Labor Productivity Improvement per Year**

| Underlying mailstream growth rate per year | Labor productivity improvement per year | | |
|---|---|---|---|
| | 0% | 1.5% | 3.0% |
| 3% | +2.7% | -13.8% | -25.6% |
| 2% | -10.1 | -23.3 | -32.9 |
| 1% | -20.4 | -30.9 | -38.6 |

NOTE: Changes in labor force requirement expressed as percentage increase (+) or decrease (-) from 1980 USPS labor force.

SOURCE: Office of Technology Assessment.

As summarized in tables 14 and 15, the projected net reduction in the total USPS labor force for these two cases is about 158,000 and 223,000 employees, respectively, with a remaining labor force in 2000 of roughly 506,568 and 452,813 employees.

The projected labor force reductions are not spread evenly among all employee groups. Almost two-thirds of the reductions would be from the post office clerks and mail handlers group—99,900 and 141,000, respectively, for the two cases shown in tables 14 and 15. This is because the work of clerks and mail handlers is more directly related to mail volume than any other employee group. In addition, USPS delivery of Generation II EMS probably would not require many of the sorting and

**Table 14.—Projected USPS Year 2000 Labor Force Requirements by Employee Group, Assuming High But Plausible Generation II EMS Growth, 2-Percent Underlying Mailstream Growth, and 1.5-Percent Labor Productivity Improvement[a]**

| Employee group | Percentage change year 2000[b] | Number of reduction from fiscal year 1980 | Employees year 2000 total |
|---|---|---|---|
| Headquarters | 0 | 0 | 2,800 |
| Regional and other field units | 0 | 0 | 6,220 |
| Inspection service | 0 | 0 | 5,240 |
| Postmasters | -7.3% | -2,120 | 26,900 |
| Post office supervisors and technical personnel | -19.9 | -7,260 | 29,220 |
| Post office clerks and mail handlers | -32.9 | -99,900 | 204,000 |
| City delivery carriers and vehicle drivers | -19.1 | -37,000 | 157,000 |
| Rural delivery carriers | -10.3 | -5,470 | 47,600 |
| Special delivery messengers | -14.9 | -373 | 2,130 |
| Building and equipment maintenance personnel | -17.2 | -5,060 | 24,400 |
| Vehicle maintenance facility personnel | -11.1 | -537 | 4,300 |
| Totals | | -158,000 | 510,000 |

[a] Roughly equivalent to 3-percent mailstream growth/3-percent productivity improvement and 1-percent mailstream growth/0-percent productivity improvement.

[b] Based on total year 2000 USPS-delivered mail volume of 88.5 billion.

NOTE: All numbers rounded to three significant figures.

SOURCE: Office of Technology Assessment.

**Table 15.—Projected USPS Year 2000 Labor Force Requirements by Employee Group, Assuming High But Plausible Generation II EMS Growth, 2-Percent Underlying Mailstream Growth, and 3-Percent Labor Productivity Improvement[a]**

| Employee group | Percentage change year 2000[b] | Number of reduction from fiscal year 1980 | Employees year 2000 total |
|---|---|---|---|
| Headquarters employees | 0 | 0 | 2,800 |
| Regional and other field units | 0 | 0 | 6,220 |
| Inspection service | 0 | 0 | 5,240 |
| Postmasters | −10.2% | −2,960 | 26,000 |
| Post office supervisors and technical personnel | −28.0 | −10,200 | 26,300 |
| Post office clerks and mail handlers | −46.4 | −141,000 | 163,000 |
| City delivery carriers and vehicle drivers | −27.0 | −52,300 | 141,000 |
| Rural delivery carriers | −14.6 | −7,750 | 45,300 |
| Special delivery messengers | −21.0 | −525 | 1,980 |
| Building and equipment maintenance personnel | −24.3 | −7,150 | 22,300 |
| Vehicle maintenance facility personnel | −15.6 | −755 | 4,080 |
| Totals |  | −223,000 | 444,000 |

[a] Roughly equivalent to 1-percent mailstream growth/1.5-percent productivity improvement.
[b] Based on total year 2000 USPS-delivered mail volume of 88.5 billion.

NOTE: All numbers rounded to three significant figures.

SOURCE: Office of Technology Assessment.

processing functions now performed by clerks and mail handlers. A lesser but still significant percentage (almost one-quarter) of the total employee reductions would be in the city delivery carrier group.

Overall, the clerks and mail handlers could be reduced by about 33 to 46 percent of their 1980 complement, respectively, for the two cases in tables 14 and 15. Post office supervisors could be reduced by about 20 to 28 percent, and city delivery carriers by 19 to 27 percent.

The projections in tables 14 and 15 do not reflect any addition of employees for operation of USPS Generation II EMS facilities. RCA estimated that 5,000 new USPS jobs would be created if a USPS Generation II EMS service were fully deployed.[13] OTA did not independently verify this estimate. However, it seems clear that, qualitatively, any increase in USPS employees for Generation II operations would be very small compared to the projected employee reductions.

Up to this point, all the discussion and analysis of projected labor force requirements has been in terms of the high but plausible Generation II EMS growth alternative. OTA conducted additional sensitivity runs to determine if the labor force changes would be significantly different under very high, moderate, and slow growth alternatives. The results are summarized in table 16. Basically, the net reduction in the overall USPS labor force would not change unless the 100-percent EMS stimulation factor applies. That is, if each Generation II EMS message stimulates a new Generation II message, then the overall labor force reduction would be somewhat less for all alternatives. The labor force reduction would then be smallest (−15.3 percent) for the very high Generation II growth alternative and largest (−20.4 percent) for the slow growth alternative.

Whether or not these labor force reductions could be handled through attrition depends largely on future USPS retirement, quit, and new hire rates. In recent years, retirements have averaged about 4 percent of the full-time labor force and about two-thirds of all separations.[14] However, over the last 10 years, net

---

[13] The RCA study conducted for USPS estimated that 5,000 new USPS jobs would be created through full deployment of the EMSS. See RCA, *Electronic Message Service System: Growth and Economic Analyses*, 1977.

[14] U.S. Department of Labor, "The Labor Impact of Instituting Electronic Mail Systems in the United States Postal Service" pp. 9-10, paper prepared for the 1979 *Presidential Review Memo* on USPS electronic mail policy.

Table 16.—Projected Year 2000 USPS Labor Force Reductions Assuming 2-Percent Underlying Mailstream Growth and 1.5-Percent Productivity Improvement

| | USPS mail volume in billions of pieces | | | |
|---|---|---|---|---|
| EMS alternative | Conventional mail | Generation II mail | Total | Labor force reduction[a] |
| High but plausible growth ....... | 75.1 | 13.4 | 88.5 | −23.3% |
| Very high growth .............. | 69.9 | 18.6 | 88.5 | −23.3 |
| Moderate growth .............. | 75.2 | 13.3 | 88.5 | −23.3 |
| Slow growth .................. | 81.8 | 6.7 | 88.5 | −23.3 |
| High but plausible growth[b] ...... | 75.1 | 26.9 | 102.0 | −17.5 |
| Very high growth[b] ............. | 69.9 | 37.2 | 107.1 | −15.3 |
| Moderate growth[b] ............ | 75.2 | 26.7 | 101.9 | −17.5 |
| Slow growth[b] ................. | 81.8 | 13.4 | 95.2 | −20.4 |

[a] Expressed as a percentage of 1980 employee levels.
[b] Assumes 100-percent EMS stimulation.

SOURCE: Office of Technology Assessment.

separations (retirements plus quits minus new hires) have averaged slightly under 1 percent. This would be adequate to absorb the projected labor reductions for the baseline alternative (assuming 2-percent mailstream growth and 1.5-percent productivity improvement). But any significant drop in the retirement and/or quit rates would mean fewer new hires, restricted promotion opportunities, and limited upward mobility. If the labor force reduction was higher than the baseline, a further cutback in new hires would be necessary. The adjustment could be quite difficult for groups that would be affected most, such as clerks and mail handlers. All of these conditions could adversely affect employee morale and complicate future contract negotiations, and deserve serious attention by USPS management and labor unions.

There is some evidence to suggest that retirement rates may decline in future years. As of 1980, the age distribution of the USPS workforce shows a bimodal distribution with peaks at about age 58 and age 33. This means that a peak has been passed in terms of the numbers of employees reaching retirement eligibility (age 55). Of course, many employees wait until age 62 or 65 to retire. The age distribution suggests that, for the next 17 years or so, decreasing although still significant numbers of USPS employees will be reaching retirement eligibility each year.[15] In addition, the removal of mandatory age 70 retirement restrictions may encourage some employees to work longer, and the poor state of the economy could discourage retirements and quits. Whether or not this poses a problem would depend on the actual retirement and quit rates in the late 1980's and early 1990's, the time when the need for significant labor force reductions (due to declining USPS-delivered mail volume) is first likely to be felt.

Finally, as noted earlier, the impact of labor force reductions would fall unevenly on the various employee groups. For example, the mail handlers would be hit especially hard, since to a substantial extent their current skills would not be needed in processing electronic mail. This might be one employee group where retraining opportunities for possible EMS jobs might be emphasized. Another related concern is that, as of late 1978, the mail handlers as a group had one of the highest percentages of black employment, more than double the USPS-wide average.[16] Thus, the possibility exists that labor reductions might fall disproportionately on black and perhaps other minority employment. This possibility warrants further study.

---

[15] Ibid., p. 8.
[16] Ibid., p. 11.

## Chapter 7

# Implications for the Telecommunication and Computer Industries, EMS Privacy and Security, and USPS Long-Term Viability

# Contents

*Page*

Introduction . . . . 73

Telecommunication and Computer Industries . . . . 73
  Fairness of USPS Role in EMS . . . . 73
  Legality of USPS Role in EMS . . . . 76
  Competition Between Generations II and III . . . . 77
  Innovation and Standards . . . . 78

EMS Privacy and Security . . . . 79

USPS Long-Term Viability . . . . 81

## Chapter 7

# Implications for the Telecommunication and Computer Industries, EMS Privacy and Security, and USPS Long-Term Viability

---

## Introduction

Although the primary emphasis of this study is on the U.S. Postal Service (USPS) mailstream and on rates, service, and labor, a discussion of the effects of a USPS role in electronic mail and message systems (EMS) on the telecommunication and computer industries, EMS privacy, and the long-term viability of the Postal Service is included.

## Telecommunication and Computer Industries

A major concern expressed in regulatory and judicial proceedings by a number of private sector telecommunication firms, and more recently by data-processing and computer firms, has been that a USPS role in EMS would constitute unfair and perhaps even illegal competition with private industry.

### Fairness of USPS Role in EMS

Private firms argue that USPS has the following advantages: 1) the Private Express Statutes (PES), which protect certain mail services from competition; 2) exemption from income taxes; 3) access to the U.S. Treasury for investment funds; 4) public funds appropriated by Congress; and 5) a cost and ratesetting process that is complex and difficult to understand, which makes cross-subsidies possible between different classes of mail.

On rebuttal, USPS has pointed out that the PES protect only letter mail from competition, and then only if it is carried over postal routes and is not time sensitive. A number of competitive alternatives to the USPS letter delivery services exist that are legal and apparently viable. These alternatives include private special messenger services; electronic message alternatives such as telephone, telegraph, telex, and privately offered "electronic mail" services; and certain kinds of media advertising (by newspaper, radio, or television) when serving as a substitute for first-class or third-class advertising mail or direct mail solicitations.[1]

Competitive alternatives to USPS nonletter mail include local and regional private delivery services and successful nationwide delivery services such as United Parcel Service (UPS), Federal Express, and Purolater. In some market segments, such as surface delivery of parcels, the competitive impact on USPS has been severe. For example, in 1957, USPS delivered about 64 percent of total parcel volume and UPS about 36 percent. By comparison, in 1977, USPS delivered only about 23 percent of total volume while UPS delivered 77 percent.[2]

---

[1] See USPS Marketing Services Division, *Competitors and Competition of the USPS*, vol. XII, September 1978 and updated yearly.

Thus, the so-called "postal monopoly" provided to USPS under the PES is limited to only a few of the many classes of mail service offered by USPS. Available evidence suggests that even among these protected services USPS market power is eroding in the face of competitive alternatives, both electronic and nonelectronic.[3] Nonetheless, the Department of Justice (DOJ), among others, believes that there is a significant chance that a USPS EMS offering (such as E-COM) could be subsidized by revenues from the USPS monopoly on delivery of first-class letter mail.

If E-COM were priced artificially below what it costs, DOJ believes that E-COM might be used at the expense of both conventional first-class mailers and the taxpayers (to the extent that USPS continues to receive public funds appropriated by Congress). DOJ also argues that underpricing of E-COM might discourage other firms from offering a similar service, thereby decreasing competition. In general, the DOJ position is that the existing regulatory structure and oversight process do not provide adequate safeguards against the impacts of E-COM that could be anticompetitive and discriminatory.

With respect to taxes, as an independent Federal Government agency USPS is not legally subject to Federal or State income taxes. Whether or not this is a real competitive advantage is a matter of dispute. USPS argues that under the Postal Reorganization Act and current ratesetting procedures it is effectively prohibited from making a profit; thus, even if it were subject to income taxes USPS generally would pay none because it would have no taxable net income. Also, while USPS does not pay property taxes on USPS-owned property, some State and local property taxes are paid indirectly when USPS is the lessee rather than the owner. Finally, USPS points out that it does not benefit from tax advantages (such as accelerated depreciation) available to private firms, and that any advantage from tax exempt status is more than offset by the costs of service and regulatory requirements imposed on it by the Postal Reorganization Act.[4] Still, to the extent that private EMS firms are profitable and pay income and other taxes, such taxes represent a cost not incurred by USPS. Some firms believe that nonprofit status offers USPS a price advantage over private competitors.

On the subject of access to the U.S. Treasury for investment purposes, the Postal Reorganization Act authorizes USPS to issue and sell obligations not to exceed $10 billion outstanding at any one time. As of September 30, 1980, USPS long-term debt totaled about $1.84 billion, consisting of $250 million in Postal Service bonds and $1.59 billion in notes payable to the Federal Financing Bank.[5] USPS observes that "private industry obtains various forms of financial aid including loans from the Treasury. Moreover, private firms do not operate under the same statutory or practical limits on their borrowing authority as does the USPS."[6] In addition, the Secretary of the Treasury has the option not to pledge the full faith and credit of the U.S. Government for USPS bond issues if the Secretary determines that it would not be in the public interest, although the Secretary has never exercised this option. Clearly, USPS competitors do not have comparable access to the U.S. Treasury for purposes of long-term borrowing, a factor that becomes even more significant when money is tight and interest rates are high.

USPS also receives annual appropriations from the U.S. Government as authorized by the Postal Reorganization Act. In fiscal year 1980, the annual appropriations totaled $1.6 billion, which included $828 million for public service costs and $782 million for revenue forgone due to free and reduced rates for certain mail services.[7] Some USPS competitors have argued that this constitutes an unfair public subsidy to the USPS. However, the revenue forgone subsidy is intended to reimburse the USPS for the revenue given up or "forgone" as a result of providing mail service free (for the blind and handicapped) or at a reduced rate (e.g., for library materials, nonprofit bulk mail, and classroom publications), as required by the Postal Reorganization Act.

---

[2] Ibid., p. 25.

[3] Ibid.

[4] Sept. 18, 1980, letter to OTA from Charles R. Braun, USPS Assistant General Counsel, pp. 11-12.

[5] *Annual Report of the Postmaster General*, fiscal 1980, p. 21.

[6] Letter from Braun, op. cit., p. 11.

[7] *Annual Report of the Postmaster General*, fiscal 1980, p. 24.

Likewise, the public service subsidy is intended to reimburse USPS "for public service costs incurred by it in providing a maximum degree of effective and regular postal service nationwide."[8] In any event, the public service subsidy was reduced from $828 million in fiscal year 1980 to approximately $468 million in fiscal year 1981.* The fiscal year 1982 continuing resolution provided a public service appropriation of about $221 million, and the Omnibus Budget and Reconciliation Act of 1981 reduced the public service authorization to $100 million for fiscal year 1983 and $0 for fiscal year 1984. The phasing out of the public service subsidy minimizes or eliminates any competitive advantage this may have given to USPS. DOJ and some private firms have expressed concern that there is nothing to prevent a future administration and Congress from reinstituting the subsidy, thereby possibly resulting in a significant USPS advantage over private industry in any competitive activity.

The USPS cost and ratesetting process is admittedly complex, which has led some private firms to be concerned about possible hidden cross-subsidies. These firms are particularly concerned about cross-subsidies from conventional mail services to EMS services; that is, the use of revenues from conventional mail to subsidize EMS costs which would keep down the rates for EMS services. OTA has not independently verified USPS costs and revenues by class of mail. However, the Postal Reorganization Act generally prohibits cross-subsidization between classes of mail and includes the requirement that "each class of mail or type of mail service bear the direct and indirect postal costs attributable to that class or type plus that portion of all other costs of the Postal Service reasonably assignable to such class or type."[9]

In addition, all USPS rate requests are subject to usually extensive and lengthy hearings conducted by the Postal Rate Commission (PRC) at which all postal rates (for all classes of mail and service) normally are considered. Many USPS competitors and mail users participate in these hearings, along with USPS, PRC and the Officer of the Commission (charged with representing the interests of the general public), and occasionally other Government agencies (such as, in the E-COM proceeding, the Departments of Commerce and Justice). Given the statutory requirements and the adversary regulatory process in which all interested parties are represented (and which itself is subject to judicial review), postal cross-subsidies would seem to be rather difficult to hide. Nonetheless, there is no absolute guarantee against cross-subsidies since the allocation of indirect and institutional costs is always somewhat arbitrary (in any organization), and the statutory criteria included in the Postal Reorganization Act may not be necessarily as applicable or appropriate now as they were when it was enacted in 1970. Some private firms are concerned that the rates initially set for E-COM service do not fully reflect the actual costs, and that at the present time there may be a hidden cross-subsidy of E-COM by other classes of mail. OTA has not independently evaluated this concern. However, the public record indicates that the PRC approved the E-COM rate of 26¢ based on an estimated capital cost of $7.4 million and first year volume of 12.5 million messages (240,000 per week). In comparison, the actual capital cost of E-COM is apparently close to $39 million, with volume averaging about 25,000 messages per week for the first 6 months of 1982.

---

[8] Ibid., p. 20.

*$1.25 billion continuing appropriation to USPS for fiscal year 1981 less $782 million revenue forgone subsidy.

[9] 39 USC 3622(b)(3). Institutional costs are also apportioned by class or service based on statutory criteria.

## Legality of USPS Role in EMS

From a strictly legal perspective, some private firms have argued that a USPS role in EMS (other than delivery of hardcopy output) is beyond the mandate of the Postal Reorganization Act of 1970, and is in direct conflict with Federal Communications Commission (FCC) regulations promulgated pursuant to the Communications Act of 1934 and with Office of Management and Budget regulations concerning Federal Government procurement of goods and services from and competition with the private sector.

The Postal Reorganization Act mandates USPS to "provide prompt, reliable, and efficient service," "give the highest consideration to the requirement for the most expeditious collection, transportation, and delivery of important letter mail," and "emphasize the need for facilities and equipment designed to create . . . a maximum degree of convenience for efficient postal services . . . and control of costs to the Postal Service."[10] Thus, USPS views its use of electronic equipment and technology as consistent with the Postal Act and as a simple extension of its prior use of, for example, automated sorting machines to carry out postal policy as defined in the act. From this perspective, EMS technology would be considered, along with the stagecoach, pony express, railroad, truck, and airplane, as another step in a long succession of new technologies used to expedite the provision of postal services. No private firm or Government agency has successfully challenged the USPS interpretation on legal grounds. In its original Opinion and Recommended Decision, PRC supported the use of EMS technology by USPS although it differed with USPS in the application of that technology. More specifically, the PRC recommended that USPS provide only the printing, enveloping, and hardcopy delivery functions and not the telecommunication function.[11]

The PRC Recommended Decision was based substantially on its finding that "the general obligation imposed on regulatory agencies to consider and promote competitive policies applies to this Commission."[12] The PRC decision was also based on the clearly procompetitive policy of FCC and the fact that the FCC asserted jurisdiction over the original USPS E-COM proposal, primarily on the grounds that it included telecommunication transmission functions to be provided by a telecommunication firm (Western Union), which was subject to FCC jurisdiction under the Communications Act of 1934.[13] PRC concluded that competition would be best served if USPS did not provide telecommunications. This also permitted PRC to avoid both a possible regulatory impasse with FCC and any direct concession of FCC jurisdiction over postal services per se.

USPS subsequently appealed the FCC ruling which asserted jurisdiction over E-COM. However, the appeal was dismissed and the FCC ruling vacated as moot by the court in view of the PRC Recommended Decision and USPS cancellation of the Western Union contract.* Thus, the court did not rule on the merits, and the legal jurisdiction of FCC over USPS involvement in EMS remains unclear.

However, regulatory developments since the FCC ruling on E-COM suggest that so-called "enhanced services" such as electronic mail may not be subject to active FCC regulation under title II of the Communications Act. In other words, as long as USPS does not own and operate its own telecommunication transmission system and uses telecommunication services of firms who are regulated as providers of so-called "basic services," the USPS EMS offerings would not necessarily be regulated by FCC.[14] The applicable FCC decision, known as *Computer II,* is still under regulatory reconsideration and judicial challenge, and also may be affected by congressional revision of the Communications Act. As noted in chapter 2, S. 898 as passed by the Senate would limit FCC jurisdiction to USPS EMS services involving USPS leasing of telecommunications from private firms, and then only to establishing costs of the telecommunication portion of the EMS service and to assuring that such service is offered by a separate organizational entity within USPS.

---

[10] Public Law 91-375, sec. 101(a), (e), and (g).

[11] U.S. Postal Rate Commission, *Opinion and Recommended Decision on Electronic Mail Classification Proposal,* docket No. MC78-3, Dec. 17, 1979, pp. 278ff.

[12] Ibid., p. 52 (caps and underlining removed).

[13] Ibid., pp. 36-51.

*See related discussion in ch. 3.

[14] Dec. 8, 1980, letter to USPS from Philip L. Verveer of FCC.

More recently, various computer service and data-processing firms, among others, have expressed concern that a USPS role in Generations I or II EMS, let alone Generation III, could violate Federal Government policy (expressed, for example, in OMB Circulars A-76 and A-121) that the Government should not produce goods and services otherwise available from the private sector and should not compete with private firms, except as a last resort. USPS has procured the computer and electronic equipment for E-COM from private firms, but USPS operation of E-COM is construed by some to constitute a computer-based electronic message processing service.[15] It is unclear whether or not this is any different from USPS owning (through purchase from private manufacturers) and operating its own fleet of nearly 120,000 vehicles as it does now.[16]

At present, the use of computers and message processing in the E-COM service is internal to USPS, and serves to convert the electronic input to hardcopy output within a given postal facility. As long as USPS is not involved in telecommunication or electronic delivery, there is no direct competition with private Generation III EMS providers. However, various Generations I and II electronic mail providers and computer service bureaus believe that USPS to some extent is competing with them. These firms have suggested several alternatives (discussed in ch. 8) to establish what would be, in their judgment, a cooperative rather than competitive relationship. As mentioned in chapter 2, H.R. 4758, introduced in the 97th Congress and the subject of extensive hearings by the House Government Operations Subcommittee on Government Information and Individual Rights,[17] would appear to have the effect of prohibiting USPS from providing data-processing or telecommunication services to non-Federal entities or persons unless explicitly authorized by statute.

## Competition Between Generations II and III

Other implications for the telecommunication and computer industries are also difficult to assess. The market penetration projections suggest that by 2000, even with 100-percent Generation II EMS stimulation, Generation III EMS volume (end-to-end electronic mail including electronic delivery) would exceed Generation II EMS volume. The sum of electronic funds transfer (EFT) (a form of Generation III) plus Generation III EMS would exceed Generation II EMS by the mid-1990's. Under the high but plausible Generation II EMS growth alternative, as shown in figure 3, Generation III EMS would surpass Generation II EMS by 1990, and EFT plus Generation III EMS would exceed Generation II EMS as early as 1985. However, Generation II EMS volume could still be substantial in 2000 and beyond, even though the Generation II market share would be declining.

To some extent, perhaps until 1990, Generation II EMS would compete with Generation III EMS for relative but not absolute market share. In developing the market penetration model, OTA assumed that development of Generation III EMS and EFT would be largely independent of the USPS role in EMS (short of a role in electronic delivery or ownership and operation of telecommunications).* Preliminary review of the initial responses to the USPS invitation for telecommunication industry participation in E-COM indicates that none of the major domestic Generation III EMS providers (such as Tymnet, GTE-Telenet, or Satellite Business Systems) indicated a desire for dedicated access to E-COM facilities. Whether this is because of continuing uncertainty over E-COM rates and service and/or because they perceive E-COM as irrelevant to, or as a competitive threat to, their own marketing and product development plans is not known.

---

[15] See Association of Data Processing Service Organizations, position paper on "Government Provision of Electronic Message Services," Feb. 16, 1982.

[16] *Annual Report of the Postmaster General*, fiscal 1980, p. 14.

[17] See statements of Philip M. Walker of GTE-Telenet and William D. English of Satellite Business Systems before the Oct. 5, 1981, hearings of the House Government Operations Subcommittee on Government Information and Individual Rights.

*See app. A.

The firms that did respond are primarily those providing international EMS service (such as ITT World Communications and Western Union International) seeking to expand into the domestic EMS market; those already providing a domestic EMS service (such as Dialcom, Inc., and Graphnet, Inc.) who presumably see E-COM as a way to increase or at least maintain their own shares of the domestic market; or those with telecommunication expertise who wish to enter a new market (such as TRT Telecommunications Corp.). TRT officials see E-COM "as a unique opportunity to participate in a new venture which has a very large market."[18]

Of the firms who actively opposed USPS involvement in EMS, Graphnet is the only one (as of December 1981) that has indicated an interest in dedicated access to E-COM. Of course, other firms will be able to gain access on a dial-up basis. One major firm with dial-up access, Western Union, has recently made application for dedicated access. Various local telephone companies have apparently expressed an interest, although AT&T has not. Even firms that are primarily in the Generation III business could supplement their service through dial-up access to the Generation II E-COM.*

## Innovation and Standards

Some private firms have expressed concern that the entry of USPS into the EMS market might stifle innovation and possibly lead toward adoption of technically inferior standards in the telecommunication industry. While these concerns were justified to some extent with respect to the original USPS proposal for E-COM, the protracted regulatory proceedings before PRC and FCC have had the effect of significantly upgrading the E-COM technology. In essence, the regulatory process in this case had the effect of mandating improvement in the E-COM design.

The final USPS provisions for interconnection between telecommunication providers and E-COM facilities at the 25 serving post offices (SPOs) appear to be substantially responsive to comments received from private firms.[19] USPS is providing four different interconnection arrangements for those firms desiring dedicated access to E-COM facilities, and two different arrangements for dial-up access at each SPO. The interconnection arrangements are summarized in appendix D. The dedicated access interconnection arrangements appear to meet the technical needs of most firms that provided comments to USPS. In addition, USPS has stated that it "will consider providing additional arrangements as necessary and feasible" and "will consider requests to accommodate user-provided interface circuit boards."[20] The dial-up access arrangements will permit dial-up access via any public telephone network.

The E-COM interconnection arrangements use technical standards that are currently accepted in the industry. Thus, it appears that while USPS cannot realistically be expected to be a source of new standards, it is not likely to impose inferior standards on the industry as long as current regulatory oversight and safeguards are maintained.

---

[18] Richard Yalen, TRT Telecommunications Vice President, as quoted in Michael Selz, "Electronic Mail Service Promises 2-Day Delivery," *The Tampa Tribune*, Dec. 10, 1981, p. 6-B.

*For example, Satellite Business Systems, Tymnet, GTE, and AT&T among others, already offer or have plans to develop nationwide networks with Generation III electronic mail capability.

[19] See USPS, "Telecommunications Connection Arrangements for Postal Service Electronic Computer Orginated Mail (E-COM) Service and Invitation for Capacity Planning Cooperation," *Federal Register*, vol. 46, No. 199, Thursday, Oct. 15, 1981.

[20] Ibid., p. 50879.

With respect to technology, the picture is less clear. The selection of technology (e.g., computers and printers) for E-COM was made by RCA under contract to USPS, not by USPS itself. Some private firms have questioned whether the best state-of-the-art technology was selected, particularly with respect to the printing equipment. USPS believes that the initial E-COM technical configuration was the best possible using off-the-shelf products with proven reliability, and given the nature of the E-COM market. USPS also believes that it can stimulate innovation in some areas, such as advanced high-volume printing and enveloping technology, where USPS is one of the largest users. However, given the relatively limited expertise of USPS in telecommunication and computer technology, and the rapid rate of private sector development, the mainstream of technological innovation appears to be beyond the scope of the USPS research and development capability, present or planned.

As for market innovation, USPS believes that a Generation II offering like E-COM will help stimulate innovation by private firms. Indeed, as mentioned earlier, some of the smaller firms that applied for dedicated access view E-COM as an opportunity to get into the EMS market and compete with the larger, more well-established firms. But various telecommunication carriers and computer service bureaus have stated that their EMS service innovation will be stifled unless the relationship with USPS is cooperative rather than competitive, and have proposed alternatives (discussed in ch. 8) that they believe will encourage maximum innovation in the EMS market.

# EMS Privacy and Security

The subject of privacy with respect to EMS includes two components of interest. One is the legal protection afforded such services, and the other is the technical vulnerability of such systems to interception of information, and the willingness and ability of system providers to secure these systems against such interception.[21]

USPS is required by law to maintain "one or more classes of mail for the transmission of letters sealed against inspection."[22] First-class mail, priority mail, express mail, and international letter mail are "sealed against inspection."

The sender's choice of the class of mail service determines whether the contents are "sealed against inspection." Generally it does not matter whether the mail is physically sealed. The message contents of a postcard are legally or constructively sealed, as are the contents of letters opened in the dead letter office to determine to whom they might be delivered. The effect of being "sealed against inspection" is to prohibit the mail from being opened without a warrant, or any use or disclosure of information obtained in the course of opening a sealed letter without a warrant. The Supreme Court has held that mail which is sealed against inspection must be considered as though it had been retained in the sender's home. It cannot be opened without the consent of the sender or addressee, except under the authority of a search warrant issued by a court upon probable cause.[23]

Access to addressor-addressee information, however, is possible without a warrant. Access to the information contained on the envelope of a letter can be secured by convincing designated postal officials that the "mail cover"—as this access is called—is needed to locate a fugitive, to obtain evidence of a crime, or to protect the national security. According to USPS, the number of mail covers is declining and the amount of mail that comes under a mail cover is very small.

---

[21] This section of the report is based in part on a 1980 USPS memorandum regarding "Applicability of Mail Privacy Legal Protections to Electronic Mail." For additional general discussion see chs. 7 and 8 of the OTA report *Computer-Based National Information Systems: Technology and Public Policy Issues*, OTA-CIT-146, Washington, D.C., September 1981.

[22] 39 USC 3623(d).

[23] *Ex parte Jackson*, 96 U.S. 727, 732-733 (1877); *United States v. Van Leeuwen*, 397 U.S. 249, 251-252 (1970).

The privacy protection afforded to mail content and addressee-addressor information passed through a telecommunication system is less clearly established. First, it does not appear that the postal statutes apply in full measure to information when it is in electronic form, perhaps even if the electronic system is operated by or for USPS and/or if the information is ultimately to be printed out and delivered as first-class mail. This is because of a distinction between information in tangible or corporeal form and information that exists in "incorporeal" form. It is only certain that the postal statutes apply when the letter is a tangible object.

Electronic communication is afforded a measure of protection by other statutes, but the degree of protection is presently somewhat less than that afforded by the postal statutes. Further, the application of these other statutes is confused. Section 605 of the Communications Act of 1934 prohibits the unauthorized disclosure of any communication by wire or radio. However, the enforcement of legal protections is more difficult when mail is in electronic form than in physical form and under the direct supervision and control of USPS.

It seems clear that the postal privacy laws and regulations would apply when an electronic message is printed out in hardcopy form at a postal facility, or printed out elsewhere and deposited into the USPS mailstream. The hardcopy output when delivered over postal routes would remain fully protected as long as it remains in the mailstream. Thus, the physical delivery of hardcopy output and the printing and enveloping of the EMS output at postal facilities would be protected.

However, the telecommunication portion of the EMS service when provided by private firms appears to be subject only to the Communications Act and not to the Postal Reorganization Act. Therefore, for services like E-COM, unless the electronic input of messages to USPS were considered to be an integral part of the service and under USPS jurisdiction, there would seem to be no obvious basis for applicability of the Postal Act.

On the other hand, where USPS provides the telecommunication (as well as the printing, enveloping, and delivery), the electronic portion of a Generation II service could conceivably be protected. USPS notes that the "question of whether these (postal) laws would apply to the electronic portion of any electronic mail services offered by the Postal Service has never been authoritatively tested," but finds that "there is little in the laws, however, to suggest that they would not."[24] In other words, according to USPS the electronic signals apparently could be construed to represent mail in postal custody even during transmission over the telecommunication portion of a postal EMS service. However, some independent privacy analysts dispute this interpretation and believe that the postal laws do not apply to the telecommunication portion of an electronic mail system.

With respect to security, legal safeguards may offer less than total protection if message contents can be intercepted by third parties with little risk of detection. Thus, security measures are intended to safeguard messages transmitted through electronic systems to protect against eavesdropping. At the present time, it is left to the telecommunication carriers to determine the degree of physical and electronic protection to be provided. Some carriers offer the user the option of encrypting data, and it may be that a market or a requirement for such protected communication will evolve.

---

[24] USPS memorandum, "Mail Privacy," op. cit., pp. 5-6.

The nature of an EMS service raises some security concerns beyond those encountered in conventional mail delivery. Because messages may be stored for some time (1 week in the case of E-COM), there is the potential for access to an historical file of traffic. Also, EMS systems could easily produce extensive data on sender-addressee patterns. Finally, the hardcopy output of EMS systems may be vulnerable to unauthorized inspection at the point of printing and/or enveloping. None of these types of security intrusion can be performed as easily or as efficiently in the conventional mail system.

In these respects, electronic mail is more vulnerable than conventional mail. Any EMS alternative that involves telecommunications, whether offered by USPS or by private firms, faces the threat of interception and monitoring of telephone, microwave, and/or satellite transmissions. While available data encryption technology can help to secure telecommunication systems, most transmissions at present are unencrypted and therefore interceptable. To the extent EMS services include growing volumes of sensitive personal, business, and financial information, the incentives to intercept such messages would increase. Some security experts have recommended that USPS provide, in cooperation with telecommunication carriers, an "electronically sealed" message service that offers protection (through encryption) at least equivalent to that of conventional first-class mail.

Electronic mail is also vulnerable to security threats at the electronic switching and computer locations (including printing and enveloping functions). The security of conventional mail is protected by sealed envelopes, diligent monitoring of postal employee activities, locked delivery and route mailboxes, and, as discussed earlier, a variety of postal statutes that provide criminal sanctions for unlawful intrusion by postal employees or private parties. Additional new security measures will be necessary at switching and computer centers involved in providing electronic mail.[25]

# USPS Long-Term Viability

The results of the OTA analysis indicate that, regardless of what role USPS plays in Generation II electronic mail, reductions in conventional mail volume due to diversion to Generation III EMS and EFT could reach significant levels by 2000. The threat to conventional mail could come even sooner if Generation III EMS services (all electronic) develop faster than currently anticipated, if the underlying growth in the mailstream is less than the historical average, or if diversion of second- and third-class mail to alternative (nonelectronic) delivery services increases significantly beyond current levels.

Moreover, almost surely by 2000, probably by 1995, and perhaps as early as 1990, Generation III EMS and EFT are likely to catch up to and pass Generation II while it begins to decline. At that point, the volume and revenue "cushion" from Generation II EMS would be reduced, and significant rate increases and/or service and labor force reductions would be likely in order for USPS to maintain a break-even operation without increased public subsidies.

Should Congress concern itself about this possibility now? While the market penetration projections could change somewhat given different assumptions, the only kinds of changes that could radically alter the projections would be a growth rate in the underlying mailstream 50 or 100 percent above the historical average, or a significant delay in the development and introduction of Generation III EMS and EFT services. Neither of these seems very likely in view of aggressive private sector Generation

---

[25] For further discussion of privacy and security, see chs. 4 and 5 of the OTA background paper on *Selected Electronic Funds Transfer Issues: Privacy, Security, and Equity*, OTA-BP-CIT-12, March 1982.

III EMS activity and the continuing economic trends that work in favor of electronic mail and against paper-based mail, especially for first-class letter mail.

For an important institution the size of USPS, 15 or 20 years is not an excessive lead time for planning an orderly transition. It can also be argued that changes are taking place so fast in the so-called "communications revolution" that by the time USPS actually experienced significant mail diversion, it would be much more difficult to adjust if steps are not taken in advance to avoid a crisis situation. For example, while normal attrition may be able to accommodate any necessary labor force reductions over the next 10 or 15 years, after that time necessary reductions may become rather severe, particularly for volume-sensitive groups of employees such as mail handlers, clerks, and part-time employees. Maintaining good employee morale and career continuity would be difficult at best under these circumstances.

As another example, significant mail diversion could undermine the ability of USPS to carry out its primary mandate "to provide postal services to bind the Nation together through the personal, educational, literary, and business correspondence of the people."[26] Reductions in USPS-delivered mail volume could generate severe financial pressures which would force service and labor cutbacks. This could translate, for instance, into reductions in the number of days of delivery, number of collection points, or number of post offices. Such cutbacks could seriously disadvantage some postal customers who may not have access to satisfactory electronic alternatives, or whose mailing needs are not amenable to electronic transmission.

On the other hand, the projections in chapter 4 indicate that USPS still is likely to have a significant though reduced volume of conventional nonelectronic mail in 2000—perhaps 70 billion to 75 billion pieces.[27] Thus, it would seem that, with orderly planning, enough of the basic USPS infrastructure could be maintained to provide adequate conventional mail services, although at reduced service levels. Also, new ways might be identified for USPS to carry out some of the elements of its statutory mandate, such as to "provide prompt, reliable, and efficient service to (postal) patrons in all areas and to render postal services to all communities,"[28] and to "provide a maximum degree of effective and regular postal services to rural areas, communities, and small towns where post offices are not self-sustaining."[29]

Generation II EMS might be able to help USPS maintain adequate service levels to rural and less populated areas that would be unable to sustain cost-effective conventional mail service at present levels under reduced mail volume. Indeed, in some rural and very remote areas where even Generation II EMS delivery might be cut back, USPS might consider contracting with Generation III EMS providers to assure regular electronic delivery to individual homes and offices or, at a minimum, perhaps to provide self-service electronic hardcopy printers in post offices or other public locations. Of course, Generation III EMS providers may find it profitable to provide such services on their own without any USPS involvement. These possibilities warrant further research.

Generation II EMS might also help USPS maintain reduced rates for certain classes of mail, such as educational and nonprofit mailings, that have been partially subsidized by the annual revenue forgone appropriation from public funds. Even if the revenue forgone subsidy is reduced, the cost advantages of Generation II EMS over conventional mail might permit the continuation of a lower rate to those many nonprofit and educational organizations that depend on the mail for their livelihood.

---

[26] Public Law 91-375, sec. 101(a).

[27] Several studies have concluded that a significant volume of paper-based mail will continue almost indefinitely. See Henry B. Freedman, "Paper's Role in an Electronic World," *The Futurist*, October 1981, pp. 11-16; and Robert W. Anthony, et al., *An Exploratory Assessment of Computer Assisted Makeup and Imaging Systems*, The George Washington University Program of Policy Studies in Science and Techology, Washington, D.C., Jan. 31, 1980.

[28] Public Law 91-375, Sec. 101(a).

[29] Public Law 91-375, Sec. 101(b).

It also seems likely that Generation II EMS service could help to meet the needs of small mailers of all kinds, even though the service may be of greatest absolute economic benefit to large mailers. For example, as of February 1982, over 90 business mailers had applied to USPS for technical certification to use E-COM service, including such high volume mailers as Shell Oil Co., Equitable Life Assurance Co., and Merrill Lynch Pierce Fenner & Smith. However, at least three of the telecommunication carriers that have applied for dedicated access (ITT World Communications, TRT Communications Corp., and Netword, Inc.) intend to offer batch mailings from low-volume mailers to meet the 200-message minimum volume requirement for E-COM use. A spokesman for ITT World Communications has indicated that "ITT would allow customers to mail as few as 25 letters per mailing" and then consolidate orders to meet E-COM volume requirements.[30]

In the longer term, it is possible that a USPS Generation II EMS capability, perhaps combined with a scaled-down version of the USPS infrastructure and delivery network, could be used to provide other Federal Government services. For example, with proper interconnection and technical enhancements, a Generation II system might be used by USPS to provide printing and delivery of various Government forms and documents.[31] This kind of role would, of course, compete to some extent with functions now carried out by the Government Printing Office, the National Technical Information Service, and other Federal agencies, but might prove to be more cost effective in the long run. This role might even be extended to include provision of abstracts of and indexes to Government forms, documents, and other kinds of Government information. These possibilities, too, deserve further study.

---

[30] Selz, "Electronic Mail," op. cit.

[31] See Robert W. Anthony, Lynne Filderman, Henry Freedman, and Henry H. Hitchcock, *Strategy for Decisions: APWU and the Electronic Information Revolution,* The George Washington University Program of Policy Studies in Science and Technology, Washington, D.C., Mar. 1, 1980; and Alfred M. Lee and Arnim H. Meyburg, *The Impact of Electronic Message Transfer on USPS Operations,* Working Paper No. 3, Cornell University Program on Science, Technology, and Society, September 1980. Also see "Electronic Computer Orginated Mail," *Technology Watch,* vol. 2, No. 2, December 1981, p. 2.

## Chapter 8

# Congressional Policy Considerations

# Contents

Page
Introduction . . . . . . . . 87

Provide a Clear Direction for USPS Involvement in EMS . . . . . . . . 89
  Impact on USPS-Delivered Mail Volume . . . . . . . . 90
  Impact on USPS Finances . . . . . . . . 90
  Impact on USPS Labor Force . . . . . . . . 90
  Space in SPOs for Carrier Output Equipment . . . . . . . . 90
  Electronic Transmission to SPOs . . . . . . . . 91
  Electronic Delivery to Recipient . . . . . . . . 91
  Interconnection and Standard Interface . . . . . . . . 92
  Transmission Facilities . . . . . . . . 92
  Marketing of EMS Services . . . . . . . . 92
  Performance Standards for EMS Services . . . . . . . . 93

Reduce or Eliminate Further Regulatory and Judicial Delay . . . . . . . . 93
  Applicability of Private Express Statutes . . . . . . . . 93
  Regulatory Jurisdiction . . . . . . . . 94
  USPS Subdivision for EMS . . . . . . . . 95

Privacy Protection . . . . . . . . 96

Maintain Oversight and Initiate Planning on USPS Long-Term Viability 97

## Chapter 8

# Congressional Policy Considerations

## Introduction

Congressional authority over the role of the U.S. Postal Service (USPS) in electronic mail and message systems (EMS) derives in the first instance from the U.S. Constitution which vests in Congress the power to establish post offices and post roads (sec. 8, clause 7) and to regulate commerce among the several States (sec. 8, clause 3).

USPS operates as an independent Federal agency pursuant to the Postal Reorganization Act enacted by Congress in 1970. It is subject to policy direction by the USPS Board of Governors and to regulatory review of mail rates and classifications by the Postal Rate Commission (PRC), both established by the Postal Act. Private EMS firms operate pursuant to the Communications Act of 1934 and regulations promulgated by the Federal Communications Commission (FCC) under authority granted by the Communications Act.

Historically, technology has been used to improve and speed up the processing, transportation, and delivery of mail. Thus, the railroad, plane, truck, and automated sorting machine have been integrated into postal operations. The Postal Act reiterates and strengthens the mandate to use new facilities and equipment to improve the convenience, efficiency, and cost effectiveness of mail service. Electronic message technology is viewed from this perspective as one more step in an evolutionary process of keeping the "post offices and post roads" up to date and competitive.

Over the last three decades, there has been a continuing revolution in computer and communication technology, a gradual deregulation of the telecommunication industry (the computer industry being essentially unregulated), and a proliferation of new and old firms offering or planning to offer EMS services. Congress has generally encouraged this deregulatory process, and continues to work to revise the 1934 Communications Act to bring it in line with current technological, economic, and competitive realities. During the last decade and a half, there has also been a concerted effort by Congress, exemplified by the 1967 "Brooks Act" amendment to the Federal Property and Administrative Services Act and the Paperwork Reduction Act of 1980, to improve the Federal Government's management and procurement of data-processing and related telecommunication equipment and services, and to rely on the private sector for provision of such equipment and services on a competitive basis wherever possible.

In essence, technological advances have reached the point where these three originally independent congressional policy directions are increasingly in conflict. USPS stands near the center of this conflict. Privately offered EMS services can and ultimately will compete with and divert a significant portion of the USPS conventional mailstream, based on the market penetration analysis in chapters 3 and 4. Absent any USPS participation, this prospect would likely lead to significant rate increases and/or service and labor force reductions by the year 2000. It seems clear that USPS can benefit from participation in providing EMS services, and indeed it can be argued (see ch. 7) that USPS has the statutory authority to participate as long as the final output is in hardcopy letter form delivered over postal roads. But even a minimal USPS role—delivery of EMS hardcopy output—is of concern to some private firms if such delivery is considered subject to the Private Express Statutes (PES). These firms believe that delivery of hardcopy output is ancillary to communication services subject to the Communications Act as well as the Postal Act.

A larger USPS role that involves message processing and computer-based printing and enveloping, as well as hardcopy delivery, apparently troubles portions of the computer industry (particularly computer service bureaus) because of concern over potential competition from USPS and the belief that the industry is willing and able to provide such services. Should the USPS role extend to the telecommunication portions of an EMS service, then many telecommunication carriers would view USPS as a direct competitor. Even with respect to E-COM, where the USPS role does not include telecommunication, some carriers are concerned that it was designed to accommodate future functions (e.g., magnetic computer tape input) that are not presently authorized. These carriers believe that any USPS involvement in telecommunication, whether directly or by resale, would be subject to the jurisdiction of the Communications as well as the Postal Act, and would constitute the entry of a Federal agency into competition with private industry. The computer service bureaus apparently feel the same way with respect to USPS provision of message processing.

Reaching a consensus on a role for USPS in EMS has been further complicated by jurisdictional conflicts between PRC and FCC, PRC and USPS Board of Governors, FCC and USPS, and the Departments of Commerce and Justice and USPS. These conflicts have come to a head over E-COM, resulting in legal actions brought in Federal court by USPS against FCC and PRC, and by Justice against USPS. Various parties, especially telecommunication value-added carriers, have filed briefs in these judicial proceedings, and before FCC and PRC in regulatory proceedings on E-COM, raising substantive issues of ratesetting, potential cross-subsidization, and privacy, among others.

On the other hand, many of the private telecommunication and computer firms who have been adversaries of USPS also believe that full development of Generation II EMS depends on a major role for USPS, but they disagree with USPS on what that role should be. Various mailer organizations, consumer groups, and postal labor unions see a USPS role in EMS as essential to USPS long-term viability and to maintaining, or at least minimizing any reductions in, mail services that are vital to a large part of the U.S. population. They point to the critical role of USPS in providing a universal, low-cost, nondiscriminatory nationwide communication service that is statutorily mandated by Congress.

Based on interviews with many of the stakeholders and USPS, as well as a comprehensive review of the historical record, OTA has concluded that, absent congressional action, the controversy over the USPS role in EMS is likely to continue. Although the U.S. District Court of Appeals has denied a Justice petition to block E-COM, further regulatory proceedings are anticipated and additional legal actions are possible. With continuing uncertainty over the future of E-COM, and in general of the USPS role in EMS, the prospects for a successful USPS entry into domestic EMS services are uncertain. Some firms have indicated to OTA that they are reluctant to make any major commitments until they are certain what role USPS is going to have. Meanwhile, many of the carriers continue to put much of their research and development effort into Generation III EMS, which would completely bypass USPS. In addition, USPS is unable to establish effective working relationships with many private carriers and potential Generation II EMS users, given the continuing adversarial atmosphere.

Should Congress wish to take action, there are several major possibilities. Congress could: 1) provide a clear direction for USPS involvement in EMS; 2) reduce or eliminate further regulatory and judicial delay; and 3) maintain oversight and initiate planning on long-term USPS viability. These possibilities are discussed below.

# Provide a Clear Direction for USPS Involvement in EMS

There are essentially nine major alternatives for a USPS role in EMS. Variations on each are possible.

1. USPS would deliver the hardcopy printed output of industry EMS services when desired and at the discretion of industry. USPS would not otherwise participate in EMS. This role would presume that hardcopy output is ancillary to communication services subject to the Communications Act and outside the scope of the Postal Act or PES.

2. USPS would deliver the hardcopy printed output of all industry EMS services when conveyed over postal roads (routes served by USPS), with exceptions for time sensitive letters. USPS would not otherwise participate in EMS. This role would be based on current USPS interpretation of PES.

3. USPS would deliver the hardcopy printed output as in 2 above, but would also permit the location of carrier Generation II EMS terminal equipment on USPS premises. This would be similar to the current role of USPS in Western Union's Mailgram service, except that equipment from several carriers, not just Western Union, would be located on premises. These carriers would then be permitted to interconnect with USPS facilities.

4. USPS would deliver the hardcopy output from industry EMS as in 2 above, and would also provide printing and enveloping portions of EMS when desired by and to meet the specifications of industry (within reason). Here, USPS would offer a range of options with respect to number of pages, paper style and format, envelope logo, and possibly inserts to meet varied needs of carriers and their customers. All carriers (defined as in E-COM to include all message-processing companies) would be permitted to interconnect with USPS facilities either on a dedicated or dial-up basis. This would be similar to E-COM, except that carriers would be able to retain their individual identity (through use of logo envelopes and possibly letterhead paper) and meet a wider range of mailer needs (through variable letter lengths and possibly inserts).

5. USPS would deliver the hardcopy output from industry EMS and would provide printing and enveloping portions of EMS on a standardized basis available to all carriers and mailers (within reasonable limits). This would be similar to the current role of USPS in E-COM. All messages would be no more than 2 pages in length, be printed on identical paper, and use E-COM logo envelopes. Other than standardized business reply envelopes, inserts are not possible. Carriers would be permitted to interconnect as in 4 above.

6. USPS would provide printing, enveloping, and telecommunication portions of EMS and physically deliver hardcopy output. USPS would lease telecommunication facilities from private industry, and would also provide interconnection for industry carriers. This would be similar to the USPS role in E-COM if there is a "demonstrated need" for USPS provision of telecommunication as well as printing, enveloping, and delivery.

7. USPS would provide printing, enveloping, the telecommunication portions of EMS, and physical delivery, as in 6 above, plus electronic delivery if there is a "demonstrated need" for certain geographical areas that can no longer sustain conventional mail service at comparable levels. USPS would lease or contract for telecommunication and electronic delivery facilities on a competitive basis from private industry, and would also provide interconnection for industry telecommunication carriers.

8. Combination of 4 and 6.

9. Combination of 4 and 7.

All of these alternatives are technically feasible. In evaluating each, Congress may wish to take into account the following considerations.

## Impact on USPS-Delivered Mail Volume

The market penetration results (ch. 4) indicated that USPS-delivered mail volume (conventional plus Generation II hardcopy output) is one key consideration. USPS-delivered volume is in part a function of the rate of Generation II EMS growth and the degree of stimulation of the Generation II EMS market. The faster the rate of growth (and the earlier the take-off) and the greater the stimulation of new message traffic, the larger the Generation II EMS volume (and hence USPS-delivered volume), assuming that USPS delivers Generation II EMS hardcopy output. There is currently little consensus on the extent to which the various alternatives would contribute to Generation II EMS growth and volume.

## Impact on USPS Finances

The revenue/cost results (chs. 5 and 6) indicated that EMS cost displacement and contribution to USPS fixed costs are also key considerations. The greater the EMS cost displacement (avoidance of conventional mailstream costs) and contribution to USPS overhead, the less likely the need for service (and labor) reductions. Again, there is lack of agreement between the USPS and major stakeholders. While Mailgram apparently provides both a substantial cost displacement and contribution to fixed costs, it is not clear whether E-COM would do likewise at current rates and in its present configuration. All parties, including USPS, agree that the RCA cost estimates prepared for the electronic message service system (EMSS) in 1977 and the original E-COM cost estimates prepared for PRC in 1978 are now outdated. A comprehensive cost review of E-COM is needed.

## Impact on USPS Labor Force

Based on the chapter 6 labor requirements analysis, the size of the USPS labor force is determined principally from the volume of USPS-delivered mail and labor productivity. There is general agreement that USPS participation in EMS would generate only a relatively small number of new jobs. However, through higher mail volumes it could offset or at least defer significant labor reductions that would otherwise be necessary.

There are an estimated 200 persons (125 operations, 50 maintenance, 25 marketing and administrative) currently working on E-COM, and a fully deployed service (at 150 serving post offices (SPOs) compared to the current 25) is estimated to require perhaps 2,000 persons.

In contrast, the additional volume from USPS delivery of industry hardcopy output under the baseline assumptions would require about 38,000 employees more than would otherwise be necessary. The additional mail volume from 100-percent Generation II EMS stimulation and high but plausible Generation II EMS growth would require 39,000 employees more than otherwise would be needed, for a total of about 77,000 employees. Put differently, under the baseline assumptions, the year 2000 USPS total labor force reduction is projected at 29 percent assuming no USPS participation in EMS (i.e., industry delivers its own Generation II EMS hardcopy output), but at only 17.5 percent for USPS-delivery of Generation II EMS output coupled with high but plausible Generation II EMS growth and 100-percent stimulation (see fig. 11 and table 16, ch. 6). Absent the 100-percent stimulation, the labor force reduction is projected at 23.3 percent.

## Space in SPOs for Carrier Output Equipment

A continuing issue is whether and how USPS should provide space on USPS premises for carrier equipment. For the Western Union Mailgram service, USPS has agreed to locate and operate Western Union printers in 144 SPOs. Other telecommunication carriers have, in the past, asked USPS for a similar arrangement. USPS indicates that it is willing to consider any serious proposals along these lines, but that none have been received. The carriers believe that USPS is not receptive to such proposals, and question why Western Union should receive special accommodation. It is not clear whether physical constraints and economies of scale would permit the location of equipment from a large number of carriers, or that a large number of carriers would find such an arrangement to be cost effective. This question deserves further study.

In E-COM, USPS does not provide space in SPOs for carrier hardcopy output devices. Instead, USPS owns and operates its own printing equipment and provides access facilities to enable carriers to interconnect directly with SPOs. USPS has purchased the interconnection equipment and leases it to carriers desiring dedicated access at a monthly charge.[1] Some carriers are not happy with the relatively limited capabilities of the E-COM equipment. According to USPS, the selection of E-COM equipment was made by RCA, and was judged to be the best technology available off the shelf that met USPS requirements. Congress could request an independent review of the technology selected.

## Electronic Transmission to SPOs

The role of USPS in the telecommunication portion of EMS has proven to be controversial. USPS originally proposed to initiate its E-COM service using a telecommunication network leased from Western Union. That is, USPS would have provided telecommunication as well as printing, enveloping, and delivery. In December 1979, PRC recommended an alternative plan under which USPS would not own or operate a telecommunication network, but all telecommunication carriers would be permitted to interconnect with E-COM at the designated SPOs. In April 1980, on remand from the USPS Board of Governors, the PRC explicitly recognized the authority of USPS to contract with a telecommunication carrier to transmit messages electronically on behalf of USPS.[2] However, PRC conditioned this authority on a showing of demonstrated need, a term that has not been clearly defined but presumably implies a situation where the needs of E-COM users could not be met adequately through the telecommunication services of private carriers. The Governors have accepted this condition.[3] However, some carriers are concerned that the ambiguity of this condition could be used in the future to, in their opinion, improperly and unjustifiably permit USPS to contract with a carrier (or carriers) to provide electronic transmission on behalf of USPS. Congress may wish to clarify the definition of demonstrated need.

## Electronic Delivery to Recipient

USPS has not proposed, nor have the Governors or PRC considered, any EMS service whereby USPS would provide electronic delivery of mail directly to the recipient. USPS has stated repeatedly that it "will not provide 'Generation III' services which transmit messages all the way through telecommunications."[4] However, some consumer advocates and researchers have suggested that electronic delivery might be justified to maintain USPS service levels in geographic areas where conventional mail service could no longer be maintained at present levels. Congress may wish to examine what, if any, conditions would constitute a demonstrated need for USPS involvement in electronic delivery (presumably by contract with private Generation III EMS firms). Any USPS role in Generation III would have to be carefully defined to avoid either the appearance or reality of competition with private firms and the substantial controversy and opposition that would likely generate.

---

[1] The monthly charge per SPO ranges from $102 to $412, depending on the type of equipment. See "Telecommunication Connection Arrangements for Postal Service Electronic Computer Originated Mail (E-COM) Service and Innovation for Capacity Planning Cooperation," *Federal Register*, vol. 46, No. 199, Oct. 15, 1981, p. 50882.

[2] Further Recommended Decision, docket No. MC78-3, Postal Rate Commission, Apr. 8, 1980.

[3] Ibid., pp. 4-9; Decision of the United States Postal Service Board of Governors, docket No. MC78-3, Feb. 22, 1980.

[4] Mar. 12, 1981, letter and position paper from Edward E. Horgan, Jr., of USPS to Sen. Barry Goldwater.

## Interconnection and Standard Interface

For E-COM, USPS provides interconnection for message input from qualifying telecommunication carriers and users (i.e., mailers) using a standard interface. Mailers may establish an account directly with USPS and prepay USPS for E-COM delivery, while arranging separately with a qualified telecommunication carrier for transmission of messages to SPOs. Alternatively, mailers may choose to deal only with a qualified telecommunication carrier that acts as an agent for E-COM service. These carriers must establish an account with USPS and prepay USPS for delivery.[5]

In E-COM, USPS is offering both dial-up and dedicated access. As explained by USPS, "the dial-up access facilities will permit customers to connect to any SPO by means of any public telephone network, using whichever telecommunication carriers the customers choose . . . Dedicated access is designed for those who wish to have exclusive access to E-COM."[6] USPS provides two standard interfaces for dial-up access and four standard interfaces for dedicated access.[7]

At the present time, carriers appear to be reasonably satisfied with these interfaces from a technical point of view, and USPS has indicated a willingness to consider other interfaces proposed by carriers. However, some carriers are not happy with the allocation of interconnection lines (or ports) at SPOs between dedicated and dial-up access, or with the total number of lines available. The total number of lines is limited by the present E-COM technology. The allocation between dedicated and dial-up access is a management decision. Congress may wish to review whether technical modifications could permit more total lines (and at what cost), as well as alternative allocation schemes.

## Transmission Facilities

USPS has not proposed, nor have the Board of Governors or PRC considered, any EMS service whereby USPS would own transmission facilities. USPS originally proposed to contract for the use of transmission facilities, as noted above. Given the wide range of privately offered transmission services and the rapid change in that industry, it seems unlikely, even in the case of demonstrated need to provide the telecommunication portion of EMS, that USPS would buy rather than lease or contract for telecommunication transmission lines.

## Marketing of EMS Services

Historically, USPS has been granted the authority (under applicable law and regulation) to market services filed and approved under the Domestic Mail Classification Schedule. While some private firms have objected to USPS marketing of EMS service, E-COM in its current form is considered to be a subclass of first-class mail under the Domestic Mail Classification Schedule. Accordingly, USPS has already initiated marketing efforts to identify customers for E-COM.[8] Even if USPS were authorized to provide telecommunications, such EMS service would most likely be filed and approved as one or more subclasses of first-class mail (and other classes of mail where electronic transmission may be appropriate), and thus could be marketed by USPS.

However, the question of how aggressively the participating telecommunication carriers would market their portion of E-COM, or any other USPS EMS service where the identity of individual firms is not retained, is an open one. Some firms have proposed the use of envelopes (and possibly paper) with the company logo, rather than or in addition to the standardized E-COM envelopes. By maintaining the individual identity of participating carriers, these firms would, in theory, have greater incentive to develop the Generation II market.

---

[5] "Telecommunication Connection," op. cit., p. 50875.

[6] Ibid., p. 50879.

[7] Ibid.

[8] USPS News Release No. 53, Oct. 19, 1981, p. 3.

### Performance Standards for EMS Services

The current E-COM service is designed to achieve guaranteed 2-day delivery. Since 2-day delivery is already guaranteed for conventional mail deposited within 600 miles of destination, the time advantage of E-COM is primarily for cross-country mail where normal delivery is 3 days. Of course, mailers may realize benefits other than time; for example, reduced printing and enveloping or computer processing costs. Still, some carriers and mailers have argued that 1-day delivery, as is available with Mailgram, would be preferable.

According to USPS, E-COM could achieve 1-day guaranteed delivery if the number of SPOs equipped with E-COM facilities were expanded from the current 25 to about 150. The total capital cost is estimated at about $250 million (roughly six times the current cost of E-COM system design and implementation), a substantial investment but considerably less than the $1.5 billion to $2.0 billion originally estimated by RCA for a nationwide electronic mail service system (EMSS). However, it is questionable whether E-COM volumes would support this investment.

In 1978, USPS projected a volume of 230 million E-COM messages 5 years out. A more recent Opinion Research Corp. survey commissioned by USPS projected a market of 500 million messages per year now and 1 billion messages per year 5 years out. This latter projection falls somewhere between the moderate and high OTA projections.

Because of the uncertainty of such projections, an incremental approach to expansion appears to be warranted. For example, E-COM (or some other alternative) could be expanded in a small number of selected origin-destination pairs (e.g., Washington, D.C.-San Francisco, New York-Los Angeles) to test the feasibility of and market for 1-day guaranteed delivery. An incremental approach would appear to require more flexibility in the USPS decisionmaking process (including regulatory review) than is presently the case. Congress may wish to consider some changes in the Postal Reorganization Act to provide more flexibility.

## Reduce or Eliminate Further Regulatory and Judicial Delay

The most important action Congress can take to reduce delay is to provide clear direction for USPS involvement in EMS, as discussed earlier. A note of caution is in order. If the direction set out is not well understood and reasonably clear and does not reflect a substantial consensus, further regulatory disputes and litigation could result.

Additionally, Congress could: 1) clarify the applicability of PES to delivery of hardcopy output; 2) delineate the division of regulatory jurisdiction between PRC and FCC; 3) mandate a separate USPS entity for any EMS offering; and 4) establish standards for protection of privacy for EMS services involving USPS.

### Applicability of Private Express Statutes

PES[9] restrict the delivery of letters by organizations other than USPS. In general, the private carriage of letters is prohibited. PES give USPS the exclusive right to carry "letters" over postal routes, with important exceptions. One exception is an administrative suspension for "extremely urgent" letters, which permits private carriage if at least $3 or twice the applicable postage is charged or, in certain cases, if delivery is completed within a matter of hours. Many electronic mail services might qualify under this exception.

---

[9] 39 U.SC. §§601-606; 18 U.S.C. §§ 1693-1699, 1724. USPS regulations implementing PES require that letters to be privately delivered over postal roads must be covered, sealed, dated, and stamped.

USPS regulations define a "letter" as a "message in writing" addressed to a "particular person," and include electronically transmitted messages when in hardcopy form and delivered over postal routes.[10] FCC, among others, has claimed that PES do not extend to physical delivery of hardcopy output from electronic communications, on the grounds that such delivery is incidental to electronic communications as defined in the Communications Act of 1934 and therefore is not subject to PES.[11] In addition, FCC has challenged a USPS proposal to redefine a previously granted exemption for telegrams. USPS had proposed to limit the exemptions to telegrams "as commonly sent in the past by other members of the public." Other forms of hardcopy output from electronic communications would not be exempt.[12] Although this proposal was subsequently withdrawn, USPS has taken the general position that its longstanding exemption for telegrams does not apply to other types of hardcopy output from electronic transmission.

Some private firms dispute the USPS position, but to date no party has successfully challenged the legality and applicability of PES to the delivery of hardcopy output as defined by USPS regulations. On the other hand, PES do not apply to end-to-end electronic communication of messages, according to recent statements by USPS officials and USPS interpretation of PES. "The PES will remain applicable only to 'hardcopy' letters."[13] "Messages transmitted by wire or wireless or electronically between sender and addressee are not letters since the PES apply only to corporeal messages physically carried on post routes."[14] However, as discussed earlier, "messages so transmitted which are converted to physical form and carried over a post road before delivery are letters,"[15] and thus are subject to PES.

Nonetheless, some private firms question not only the applicability of PES to Generation II hardcopy delivery, but are also concerned that USPS may attempt to extend PES to Generation III EMS. Congressional clarification may be needed.

## Regulatory Jurisdiction

Over the last 3 years, the question of which regulatory bodies have what jurisdiction over various USPS proposals for offering EMS service has been considered extensively in regulatory proceedings. In two court actions, USPS has challenged the extent of appropriate jurisdiction as asserted by both PRC and FCC.

By declaratory ruling, FCC asserted authority under section 2(a) of the Communications Act of 1934[16] to regulate parts of the original USPS plan for E-COM. This plan called for USPS to contract for transmission and other services on a sole source basis with a single common carrier (Western Union).[17] FCC apparently based its assertion on the grounds that Western Union was already subject to FCC regulation, and furthermore, to the extent that USPS offered electronic communication services, it was a "person" within the meaning of the Communications Act and was therefore itself subject to FCC jurisdiction.[18] USPS petitioned the U.S. Court of Appeals for the District of Columbia for a review of the FCC action arguing that, under the Postal Reorganization Act of 1970, PRC is the appropriate regulatory body and further that USPS is not a "person" subject to the jurisdiction of FCC. On October 14, 1980, the court dismissed the USPS appeal and vacated the FCC ruling as moot for two reasons: 1) "the contract between Western Union and the

---

[10] 39 C.F.R. 152 (1970) and USPS order 71-10.

[11] Mar. 12, 1979, letter to Louis A. Cox, USPS General Counsel, from Robert R. Bruce, FCC General Counsel, pp. 2-3.

[12] 43 Fed. Reg. 60,616 (1978); 45 Fed. Reg. 59,871 (1980).

[13] Horgan letter, op. cit.

[14] USPS, *Interpretation of PES*, 1973 report, p. 7.

[15] Ibid.

[16] 47 U.S.C. §152(a).

[17] Postal Rate Commission, docket No. MC78-3.

[18] Federal Communications Commission Common Carrier Docket No. 79-6; in the matter of request for declaratory ruling and investigation by Graphnet Systems, Inc., concerning the proposed E-COM service.

Postal Service . . . that was objectionable to the FCC has been cancelled, and 2) PRC itself rejected several features of the Postal Service electronic mail system proposal found objectionable by the FCC."[19] Thus, the court did not rule on the merits of the case and the legal jurisdiction of FCC over USPS involvement in the telecommunication portion of EMS remains unclear.

USPS also petitioned the court for review of that part of the PRC Final Recommended Decision that designates E-COM as an "experimental" subclass of first-class mail authorized only through October 1, 1984. Basically, USPS claimed that PRC far exceeded its authority and sought to exercise a power reserved to the USPS Board of Governors.[20] In June 1981, the court ruled for USPS and remanded the matter back to PRC for further consideration.[21]

However, two issues were still in dispute. First, PRC believed it was proper to review the entire E-COM decision, not just the "experimental" designation which was the subject of the court proceeding. A number of communication carriers and others (including the Departments of Commerce and Justice) who filed statements with PRC took the position that the court, in effect, vacated the PRC Recommended Decision in toto, and that USPS was not authorized to proceed with E-COM on January 4, 1982. USPS maintained that the court's remand, and therefore PRC's reconsideration, extended only to the question of "experimental" designation and that USPS was otherwise authorized to initiate E-COM service in January. In December 1981, PRC suspended the proceedings, leaving the legal status of E-COM uncertain. On January 4, 1982, USPS started E-COM service. In April 1982, the U.S. Court of Appeals for the District of Columbia denied a Department of Justice petition to block implementation of E-COM.

Absent clear direction from Congress, it seems likely that USPS entry into EMS will precipitate continued regulatory (and related judicial) conflicts. Congress, through legislation or otherwise, could clarify regulatory jurisdiction over USPS involvement in EMS. For example, this might take the form of the amendment to S. 898 which stipulates that FCC shall establish costs for the telecommunication portion of any USPS EMS service and shall assume that any such telecommunication services are offered by a separate organizational entity within USPS. Apart from these two provisions, the amendment to S. 898 states that FCC shall not regulate USPS.[22] As another example, Congress might clarify—through an amendment to the Postal Act—the extent of PRC jurisdiction over a USPS role in EMS.

## USPS Subdivision for EMS

As discussed in chapter 7, a number of private firms and other parties have expressed concern that USPS involvement in EMS would constitute unfair competition between an independent Government agency and the private sector. This concern focuses in part on the possibility that USPS might use public appropriations or revenues from other USPS services to cross-subsidize EMS services. In July 1979, the White House proposed the creation of a separate USPS subdivision for EMS service in order to make cross-subsidies easier to detect and prevent. The original White House proposal suggested "a separate entity for accounting and ratemaking purposes."[23] H.R. 2813 would require USPS to establish by regulation "a separate organizational unit . . . to provide for the management of all electronic mail service of the USPS."[24] S. 898 would require "a separate organizational entity" for any telecommunication services offered by USPS.[25]

---

[19] Oct. 14, 1980, Order, U.S. Court of Appeals.

[20] Decision of the Governors of the U.S. Postal Service, Aug. 15, 1980.

[21] 654 F 2d. 108 D.C. Court of Appeals 1981.

[22] *Congressional Record—Senate*, Oct. 7, 1981, p. S.11211.

[23] Administration Policy Statement, The White House, July 19, 1979.

[24] H.R. 2813, 97th Cong., 1st sess., Mar. 25, 1981, p. 2.

[25] *Congressional Record—Senate*, Oct. 7, 1981, S.11211.

USPS has already established a separate Office of E-COM Operations and implemented detailed cost accounting procedures which, according to USPS, are more stringent than anywhere else in the organization. USPS has initiated a complete review of E-COM costs to date, recognizing that some costs have been higher than initially estimated and that rate adjustments may be necessary so that costs are fully covered over a given period of operation and projected volume. However, Congress may wish to consider stronger safeguards (e.g., outside audit) and a greater degree of organizational separation to prevent cross-subsidization and allay private sector fears.

## Privacy Protection

Privacy protection in a USPS EMS service is a continuing issue. First raised in the original PRC consideration of the E-COM proposal, a 1982 National Research Council (NRC) report[26] has amplified the privacy and security concerns discussed in chapter 7. To quote from the NRC report: "Electronic mail presents potentially serious problems of security and privacy protection. The processing, storage, and transmission of large amounts of data, which are functions central to electronic mail, offer an attractive target for anyone seeking access to individual and corporate information."[27]

OTA has not conducted a thorough review of E-COM security and privacy. However, preliminary discussions with USPS indicate that while some protections are in place, additional security measures appear to be necessary. The E-COM equipment is apparently physically secure, but the technical configuration makes it possible for the operator to read the hardcopy printouts before being enveloped. Operators are instructed not to read the contents, and unauthorized personnel are not permitted in the E-COM facilities when printers are in operation. Nonetheless, the potential for security breaches does exist.

A second potential problem is that the user (carrier or mailer) account numbers are printed on the outside of E-COM envelopes, thus guaranteeing dissemination in a physically visible manner of one of the two pieces of information needed to use E-COM. The account number, together with an access code and familiarity with the E-COM technical interconnection standards, would permit unauthorized use of E-COM. A third potential problem is that all incoming messages are stored for 1 week in computer memory or on magnetic tape in the E-COM computers. While this archiving may be necessary in case of errors in message conversion or transmission, it also could present another target for security violations. This security risk is heightened by the fact that computers at each of the 25 E-COM locations are interconnected electronically to the USPS management operations center in Wilkes-Barre, Pa. The purpose of the management information system is to validate account numbers and access codes and keep track of message volume by account. However, it may be technically possible to tap the archived messages via the management information system which apparently uses dedicated, but not otherwise secure, leased telephone lines.

Congress may wish to mandate an independent review of E-COM security to ensure that the necessary security measures are either in place or implemented shortly. Since it appears that the postal statutes do not at present extend to the electronic transmission portion of Generation II EMS, or at least it is not clear that the statutes apply, Congress may wish to consider the possibility of amending the Postal Act and/or Communications Act to provide additional statutory protection, and consider the use of data encryption to provide additional technical protection.

---

[26] National Research Council, Assembly of Engineering, Committee on Review of U.S. Postal Service Planning for Electronic Mail Service Systems, *Review of Electronic Mail Service Systems Planning for the U.S. Postal Service*, National Academy Press, Washington, D.C., 1981.

[27] Ibid., p. xi.

# Maintain Oversight and Initiate Planning on USPS Long-Term Viability

While the immediate focus is on E-COM, providing a clear direction for USPS involvement in EMS and resolving current regulatory problems and delays, EMS issues are likely to be with Congress for many years. Issues will be driven by the impact of EMS on USPS, the role of USPS in EMS, and the broader impact of EMS on American society and the public at large. For a discussion of these broader impact areas, see the related OTA report on *Computer-Based National Information Systems* (1981).

As the historical (and legal) distinctions between conventional and electronic mail are blurred by technological advances, Congress will be called on to maintain oversight and initiate planning on the long-term viability of USPS for all the reasons cited in chapter 7.

At present, it is difficult for USPS to conduct effective long-range planning with respect to EMS, since this requires good working relationships with private telecommunication and computer firms, many of whom have been and/or are adversaries of USPS. If some clearer consensus can be reached on the direction and limits of USPS involvement in EMS, perhaps a more constructive relationship with the private sector can develop.

USPS reports that the EMSS concept is essentially on hold, and that a new or modified, and more incremental rather than total systems, approach to planning may be adopted. Given the dynamic nature of the telecommunication and computer industries, USPS can hardly be expected to develop the best concept for its own role without the flexibility to test and try out various alternatives, on a limited basis. In most successful private firms, the introduction of any major new product or service is preceded by a long series of research, development, and market testing of several options to hopefully arrive at the one that is most competitive and cost effective. At present, regulatory and institutional constraints make it very difficult for USPS to experiment. In any realistic sense, E-COM should be viewed as an experiment, designed to be modified as operating and market experience identifies areas for improvement or change. In a more supportive climate, USPS might conduct some joint technical and market tests with various private firms in different parts of the country. The results could then help guide the evolution from Mailgram and E-COM to a long-term partnership with the private sector that reconciles the statutory mandate of both the Postal and Communications Acts to the ultimate benefit of the American public.

# Appendixes

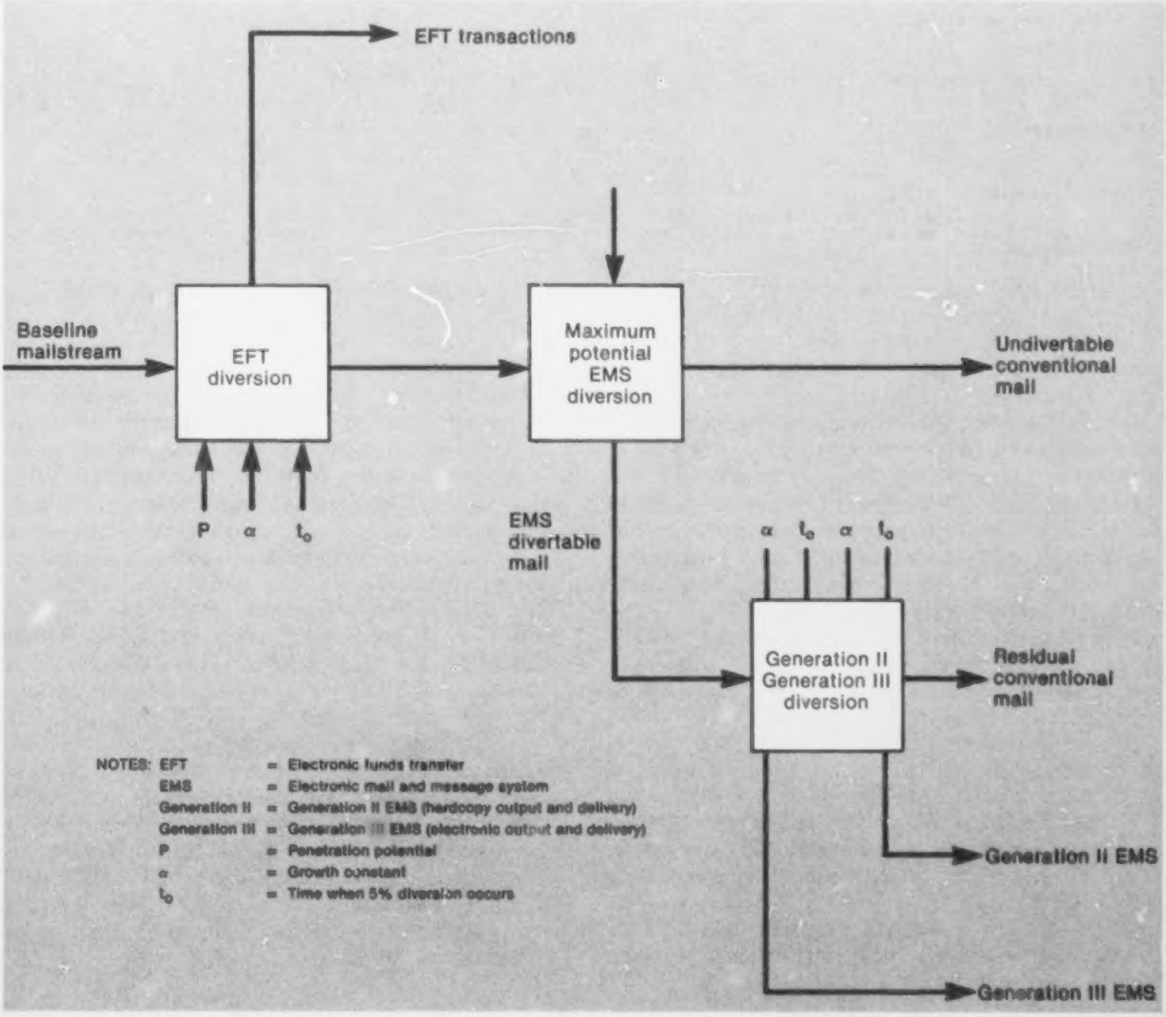
## Appendix A

# Supplemental Detail on the Market Penetration Model

## Narrative Discussion

Appendix A includes the following. Figure A-1 shows the structure of the model with the diversion parameters (P, $\alpha$ , $t_o$) indicated for electronic funds transfer (EFT) and Generations II and III electronic mail and message service (EMS). Table A-1 provides complete detail on the baseline mailstream.

**Figure A-1.—Structure of Market Penetration Model**


EFT transactions
Baseline mailstream
EFT diversion
P
α
$t_o$
Maximum potential EMS diversion
Undivertable conventional mail
EMS divertable mail
α
$t_o$
α
$t_o$
Generation II Generation III diversion
Residual conventional mail
Generation II EMS
Generation III EMS

NOTES: EFT = Electronic funds transfer
EMS = Electronic mail and message system
Generation II = Generation II EMS (hardcopy output and delivery)
Generation III = Generation III EMS (electronic output and delivery)
P = Penetration potential
$\alpha$ = Growth constant
$t_o$ = Time when 5% diversion occurs

SOURCE: Office of Technology Assessment.

**Table A-1—Baseline Mailstream, 1977, Billions of Pieces**

| | To households | | | | | | To nonhouseholds | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mail content/class | First | Second | Third | Fourth | Other | Totals | First | Second | Third | Fourth | Other | Totals |
| ***From households*** | | | | | | | | | | | | |
| Correspondence | 6.6 | ..... | ..... | .... | 0.2 | 6.8 | 1.4 | ..... | ..... | ..... | (a) | 1.4 |
| Negotiable instruments | 0.1 | ..... | ..... | ..... | ..... | 0.1 | 6.5 | ..... | ..... | ..... | ..... | 6.5 |
| Merchandise | (a) | ..... | (a) | 0.1 | ..... | 0.1 | — | (a) | (a) | (a) | ..... | 0.1 |
| Miscellaneous | 0.1 | ..... | ..... | ..... | ..... | 0.1 | 1.2 | ..... | ..... | ..... | ..... | 1.2 |
| Totals | 6.8 | ..... | (a) | 0.1 | 0.2 | 7.1 | 9.1 | (a) | (a) | (a) | (a) | 9.2 |
| ***From nonhouseholds*** | | | | | | | | | | | | |
| Correspondence | 1.5 | — | 0.1 | (a) | 0.1 | 1.7 | 5.2 | — | 0.5 | — | ..... | 5.7 |
| Negotiable instruments | 1.8 | — | (a) | — | (a) | 1.9 | 1.5 | ..... | ..... | ..... | ..... | 1.5 |
| Merchandise | 0.2 | (a) | 0.5 | 0.3 | 0.1 | 1.2 | — | — | 0.7 | 0.1 | ..... | 0.8 |
| Bills | 8.8 | — | 0.1 | — | (a) | 8.9 | 8.4 | — | 0.1 | — | ..... | 8.5 |
| Financial statements | 2.6 | — | (a) | — | (a) | 2.6 | Included in bills | | | | | |
| Legal/financial instruments | — | — | — | — | — | — | 1.9 | — | — | — | ..... | 1.9 |
| Other nonadvertising | 6.0 | 8.3 | 9.5 | 0.1 | 0.1 | 24.0 | — | 0.9 | 2.3 | ..... | ..... | 3.2 |
| Advertising | 1.1 | 0.1 | 7.2 | 0.1 | (a) | 8.5 | 2.3 | — | 3.0 | — | ..... | 5.3 |
| Miscellaneous | 0.5 | — | 0.4 | — | — | 0.9 | — | — | — | — | ..... | — |
| Totals | 22.5 | 8.4 | 17.9 | 0.5 | 0.4 | 49.7 | 19.3 | 0.9 | 6.6 | 0.1 | 0.3 | 27.3 |

[a] Between 0.01 and 0.05 billion pieces.

SOURCES: Office of Technology Assessment; and M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report*, prepared for the Mail Classification Division, USPS, 1978. Also, *Nonhousehold Mailstream Study, Interim Report for First Postal Quarter PFY 1979*, July 1979. First-class mail includes penalty and franked mail.

The major mail segments in table A-1 were regrouped to combine some of the smallest categories, and to further divide some of the larger categories. For example, household/household correspondence was separated into letters and greeting cards, since the potential for electronic handling of letters may be significantly greater than that of greeting cards. Also, nonhousehold/nonhousehold correspondence was separated into intracompany and intercompany categories, since the potential for electronic handling of intracompany mail may be developing significantly faster than for intercompany mail. The miscellaneous categories, merchandise, and segments with a volume of less than 1 billion pieces per year were combined into one expanded miscellaneous category for each class of mail.

The mailstream segments resulting from this regrouping are listed in table A-2, along with the mail class (first, second, third, fourth, other) and 1977 baseline mail volume for each segment. Those segments judged to be susceptible to penetration by EFT and/or EMS are marked by an "X" in table A-2.

Table A-3 provides further detail on the EFT diversion parameters (P, $\alpha$, $t_0$) for each mailstream segment judged to be susceptible to EFT.

Table A-4 provides complete detail on the Generation II and Generation III EMS diversion parameters. In order to simplify the analysis, the 26 mailstream segments listed in table A-2 were consolidated into 12 segments shown in table A-4. For the purposes of table A-4, the analysis focused on the type of mail content and sender/receiver pairs, rather than on different classes of mail. The parameters that determine the growth and timing of the projected Generation II logistic substitution curve for each mailstream segment are summarized in the upper half of the cells in table A-4. For each mailstream segment (column), the values $\alpha$ and $t_0$ for Generation II are listed in the row opposite the technology that controls growth and timing for that segment. For example, for Generation II household-household (H-H) greeting cards, $\alpha = 0.2$ and $t_0 = 1995$ is projected, based on the estimated availability of cost effective advanced electronic printers. The parameters that determine the growth and timing of the projected Generation III logistic substitution curve for each mailstream segment are shown in the lower half of the cells in table A-4. Again, the values are shown in the row opposite the controlling technological development.

## Table A-2.—Mailstream Segments

| Mailstream segment | Mail class | 1977 volume[a] | Penetration by: EFT | Penetration by: EMS |
|---|---|---|---|---|
| H-H letters | 1 | 3.4 | — | X |
| H-H greeting cards | 1 | 3.2 | — | X |
| H-NH correspondence | 1 | 1.4 | — | X |
| NH-H bills | 1 | 8.8 | X | X |
| NH-H financial statements | 1 | 2.6 | X | X |
| NH-H other nonadvertising | 1 | 6.0 | — | X |
| NH-H other nonadvertising | 2 | 8.3 | — | X |
| NH-H other nonadvertising | 3 | 9.5 | — | X |
| NH-H correspondence | 1 | 1.5 | — | X |
| NH-H advertising | 1 | 1.1 | — | X |
| NH-H advertising | 3 | 7.2 | — | X |
| NH-NH advertising | 1 | 2.3 | — | X |
| NH-NH advertising | 3 | 3.0 | — | X |
| NH-NH intracompany correspondence | 1 | 3.2 | — | X |
| NH-NH intercompany correspondence | 1 | 2.0 | — | X |
| NH-NH other nonadvertising | 3 | 2.3 | — | X |
| NH-NH bills and statements | 1 | 8.4 | X | X |
| H-NH negotiable instruments | 1 | 6.5 | X | |
| NH-H negotiable instruments | 1 | 1.8 | X | |
| NH-NH negotiable instruments | 1 | 1.5 | X | |
| NH-NH legal/financial instruments | 1 | 1.9 | | |
| Miscellaneous | 1 | 2.1 | | |
| Miscellaneous | 2 | 1.0 | | |
| Miscellaneous | 3 | 2.5 | | |
| Miscellaneous | 4 | 0.7 | | |
| Miscellaneous | 0 | 0.9 | | |

[a]billions of pieces of mail

H = Household
NH = Nonhousehold
1 = First-class
2 = Second-class
3 = Third-class
4 = Fourth-class
0 = Other class

SOURCE: Office of Technology Assessment.

## Table A-3.—EFT Mail Diversion Parameters

| Mailstream segment | 1977 volume (billions) | Penetration potential (P) | Growth constant $(\alpha)$ | Time when 5 percent diversion occurs $t_o$ |
|---|---|---|---|---|
| NH-H bills | 8.9 | 0.9 | 0.20 | 1985 |
| NH-H financial statements | 2.6 | 0.9 | 0.20 | 1985 |
| NH-NH bills, statements, etc. | 8.4 | 0.9 | 0.20 | 1985 |
| H-NH negotiable instruments | 6.5 | 1.0 | 0.20 | 1985 |
| NH-H negotiable instruments | 1.9 | 1.0 | 0.20 | 1985 |
| NH-NH negotiable instruments | 1.5 | 1.0 | 0.20 | 1985 |

SOURCE: Office of Technology Assessment; see OTA, *Selected Electronic Funds Transfer Issues: Security, Privacy, and Equity*, OTA-BP-CIT-12, March 1982, for further discussion of EFT trends and developments which are generally consistent with the EFT diversion parameters.

**Table A-4.—EMS Technology Assumptions and Diversion Parameters by Mail Content and Sender/Receiver Pair**

| From-to |  | N-N Intra |  | N-N Inter |  | N-N |  | N-N |  | N-N |  | N-H |  | H-H |  | H-H |  | H-N |  | N-H |  | N-H |  | N-H |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Content |  | Corr |  | Corr |  | Other non-advertising |  | Bills |  | Advertising |  | Advertising |  | Cards |  | Corr |  | Corr |  | Corr |  | Other non-advertising |  | Bills and statements |  |
| Penetration | Generation II | 100% |  | 100% |  | 70% |  | 100% |  | 100% |  | 100% |  | 100% |  | 100% |  | 100% |  | 100% |  | 70% |  | 100% |  |
|  | Generation III | 100% |  | 100% |  | 70% |  | 100% |  | 100% |  | 30% |  | 30% |  | 100% |  | 100% |  | 100% |  | 70% |  | 100% |  |
| Early electronic printers | II |  |  | 30% | 1983 | 30% | 1983 | 30% | 1983 |  |  |  |  |  |  |  |  |  |  | 30% | 1983 | 30% | 1983 | 30% | 1983 |
|  | III |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Advanced electronic printers | II |  |  |  |  |  |  |  |  | 20% | 1995 | 20% | 1995 | 20% | 1995 |  |  |  |  |  |  |  |  |  |  |
|  | III |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| EDP and office automation | II |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | III | 30% | 1983 | 20% | 1984 | 20% | 1984 | 20% | 1985 | 20% | 1987 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Home computer terminals | II |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 30% | 1987 | 30% | 1987 |  |  |  |  |  |  |
|  | III |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 20% | 1987 | 40% | 1987 | 40% | 1987 | 40% | 1987 |  |  |
| Viewdata/teletext | II |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | III |  |  |  |  |  |  |  |  |  |  | 40% | 1985 | 20% | 1985 |  |  |  |  |  |  |  |  |  |  |
| Inexpensive HC receiver | II |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | III |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 20% | 1990 |

N = Nonhousehold
H = Household
$\alpha$ = Initial rate of growth
$t_0$ = Year of 5% diversion

| Key to Entries: | $\alpha$ | $t_0$ |
|---|---|---|
| Generation II EMS |  |  |
| Generation III EMS |  |  |

SOURCE: Office of Technology Assessment.

Table A-5 shows the actual procedure used by the computer program to obtain the overall diversion results. The computer program applied an underlying growth rate to each mailstream segment, and then calculated the portion of each segment diverted to EFT, Generation II EMS, and Generation III EMS. These diversion estimates were calculated using the logistic growth curve (described in app. B) for each mailstream segment, with the parameters P (penetration potential), $\alpha$ (growth constant) and $t_0$ (time of 5-percent penetration), as specified earlier in tables A-3, A-4, and A-5. The diversion estimates for each mailstream segment were then added together to give overall estimates for residual conventional mail volume and for the volumes of mail diverted to EFT, Generation II EMS, and Generation III EMS.

Diversion estimates were calculated for the years 1985, 1990, 1995, and 2000. As explained in chapter 3, the results of the computer runs were adjusted upward by 10 percent (multiplied by a factor of 1.10) to compensate for the difference between the projected and actual growth rate in the mailstream for the years 1977-81.

**Table A-5.—Procedure Used by Computer Program for Market Penetration Projections**

1. Select the year, t, for which diversion estimates are to be calculated.
2. Compute a "UG" factor for the underlying growth in the mailstream relative to 1977. For most runs the assumption was 2 percent compounded growth. Hence the "UG" factor is 1.02 raised to the power (t-1977).
3. Compute EFT penetration for each of the segments in table A-2 which are penetrated by EFT. First compute the penetration fraction f using the logistic substitution formula in appendix B, and the values of $\alpha$ and $t_0$ from table A-3. Then multiply the 1977 volume × the "UG" factor × the penetration potential P (from table A-3) × f. This yields the volume diverted to EFT in year t for each mailstream segment.
4. Reduce the 1977 volumes for segments affected by EFT by the amount of EFT diversion before computing EMS diversion.
5. Compute diversion to Generation III EMS for each mailstream segment affected by EMS just as in step 3 above for EFT, except use the reduced 1977 volumes for EFT impacted segments, and use $\alpha$, $t_0$, and P for Generation III from table A-4. The penetration potential P is contained in the third row of table A-4 (marked "PENETRATION"). The $\alpha$ and $t_0$ values for Generation III are in the lower half of the cells in table A-4.
6. Compute diversion to Generation II EMS for each segment in the same manner as in step 5 above, using $\alpha$ and $t_0$ from the upper half of each cell in table A-4. Then reduce the computed Generation II volume by the computed Generation III volume. If the Generation III volume exceeds the Generation II volume, then Generation II volume is zero.
7. Add results across mailstream segments for each class of mail to get diversion totals by class of mail.

SOURCE: Office of Technology Assessment.

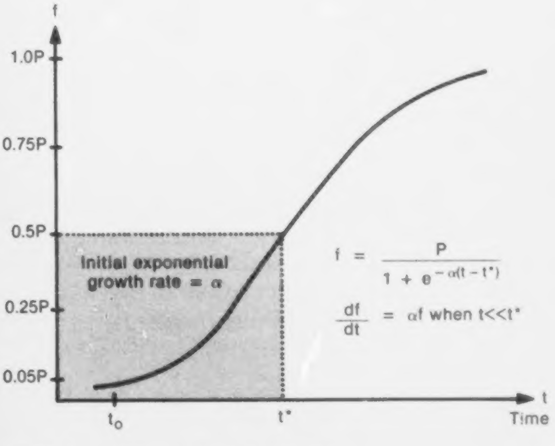
## Appendix B

# Logistic Substitution Process

The logistic substitution process is one mathematical formulation that can be used to describe the encroachment of one technology on the market of another. In the field of systems ecology a multitude of models have been used for this purpose. However, the more complex models require data that are significantly more detailed than were available for this analysis, and for all their complexity have no more inherent validity than a simple model such as logistic substitution. The most important considerations for any model used for this kind of analysis are that it be based on supportable data and that it make sense.

The logistic substitution curve (fig. B-1) presents a reasonable macroscopic model of the encroachment of a new technology into the market of an established, mature technology. When the new technology becomes available, it penetrates the market slowly at first due to relatively high cost and limited consumer acceptance. As time goes on, cost declines as volume of use builds, leading to an accelerating growth. Growth remains gradual, however, since consumer acceptance can be gained only with time. As the available market approaches saturation, the rate of growth declines.

Figure B-1.—Logistic Substitution Growth Process



NOTES: P = Maximum penetration potential
f = Market share (fraction of total market) for new technology at time t
$\alpha$ = Growth constant
$t_0$ = Time when 5% penetration occurs
$t^*$ = Time when 50% penetration occurs

SOURCE: Office of Technology Assessment and Fred B. Wood, et al., *USPS and the Communications Revolution: Impact, Options and Issues*, George Washington University, Mar. 5, 1977.

In mathematical terms, the key variable is the market share of the new technology, expressed as a fraction f of the total potential market. Ultimately, the entire potential market will be penetrated, and f will equal 1 or the maximum penetration potential P, whichever is less. Initially, the market share fraction f is very small, but grows with time at a rate proportional to the market share itself. Thus, in the early stages of growth, the growth of f per unit of time is expressed as $\alpha \times f$, where $\alpha$ is a constant for the particular technology and market being considered. The factor $\alpha$ will be referred to as the "growth constant" for the particular substitution process. It is a measure of how quickly the technology will penetrate the market. For example, with $\alpha = 0.4$ (per year), the market share will rise from 5 to 75 percent in 10 years, whereas with $\alpha = 0.2$ such a change in market share will require 20 years.

The market share at any time can be computed from the equation in figure B-1 if the growth constant $\alpha$ and the time of 50-percent market penetration t are specified. Alternatively, some other point on the curve can be specified along with the growth constant $\alpha$. OTA chose to specify a particular logistic substitution curve by specifying the growth constant, $\alpha$, and the time (calendar year) at which 5-percent penetration of the available market occurs. This 5-percent penetration time is designated $t_0$. The market share f can then be expressed in terms of $\alpha$ and $t_0$ as follows:

$$f = \frac{P}{1 + e^{(2.944 - \alpha (t - t_0))}}$$

$$f = \frac{P}{1 + 19e^{-\alpha (t - t_0)}} \quad \text{where } \begin{array}{l} 0 \leq P \leq 1 \\ 0 \leq f \leq 1 \\ 0 \leq \alpha \leq 1 \end{array}$$

The logistic substitution process has been used once before to model the penetration of mail by EMS technology.[1] However, in that 1977 study the mailstream was considered a single market and the substitution of EMS a single process. For the purposes of this study, the mailstream was considered to be many different submarkets with varying susceptibility to several different EMS technologies.

---

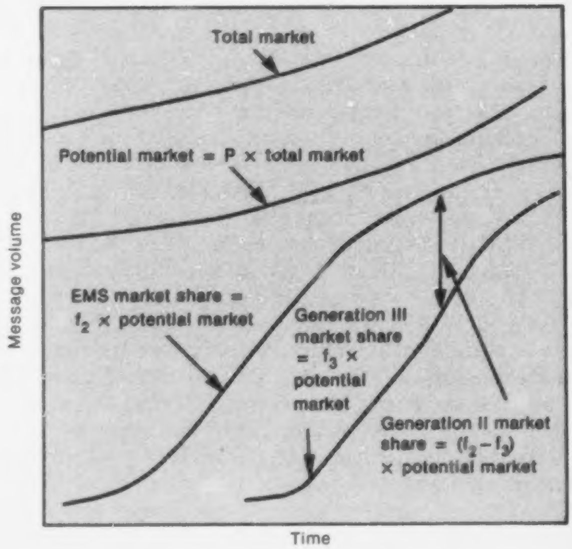
[1] Fred B. Wood, et al., *USPS and the Communications Revolution: Impacts, Options and Issues*, George Washington University, Mar. 5, 1977.

The competition between Generation II and Generation III EMS technologies can be described as follows. As EMS technology develops, Generation III systems eventually will most likely be less expensive to use than Generation II systems because Generation III employs electronic, rather than postal carrier, delivery. Also, Generation III EMS technology will most likely advance to the point where it will be able to accommodate any format or display capability that can be handled by Generation II. In other words, any mailstream segment that can be diverted to Generation II EMS can eventually be diverted to a Generation III system as well. Furthermore, the switch to Generation III EMS will most likely occur when the economics (to the user) favor Generation III over Generation II EMS, and at that point Generation III systems will start to take away market share from Generation II systems.

Thus, in the market penetration model, penetrations of conventional mail by Generation II EMS and Generation III EMS were calculated separately using parameters derived from an assessment of relevant technologies.* The volume resulting for Generation III was then subtracted from the resulting Generation II volume, producing a net Generation II volume figure. The net Generation II and Generation III volumes were subtracted from the conventional mail volume to obtain the residual conventional volume.

Figure B-2 illustrates the relationships involved in a market segment where a portion of the total message volume is judged suitable for penetration by EMS. First, the total market in this segment is shown as one that grows at a constant percentage rate. The potential market for EMS—the portion of the market which is physically suitable for eventual transmission by EMS systems—is represented as a constant fraction P of the total market. Initially, Generation II EMS begins to penetrate the potential market, capturing a market share $f_2$ of the total market. Later, Generation III begins to penetrate. At this point, the fraction $f_2$ represents the total EMS market share, and Generation III growth comes at the expense of Generation II. Hence $f_3$, the result of a separate substitution process, represents the market share for Generation III, while the market share for Generation II becomes $f_2 - f_3$. For the assumptions used in this study, total substitution of Generation III for Generation II does not occur in any mailstream market segment within the 20 year timeframe of the market penetration projections.

**Figure B-2.—Logistic Substitution Process for Generation II vs. Generation III EMS**


Total market
Potential market = P × total market
Message volume
EMS market share = $f_2$ × potential market
Generation III market share = $f_3$ × potential market
Generation II market share = $(f_2 - f_3)$ × potential market
Time

NOTES: P = Maximum penetration potential
$f_2$ = Fraction of total market for EMS at time t
$f_3$ = Fraction of total market for Generation III at time t
$f_2 - f_3$ = Fraction of total market for Generation II at time t

SOURCE: Office of Technology Assessment.

---

*See table A-4.

## Appendix C

# Equation Used to Calculate Labor Requirements

$$L_r = 1 - \left[ 1 - \frac{V_x}{(V_{1980})\,(LP_x)} \right] \left[ \frac{VC}{100} \right]$$

where $L_r$ = labor requirement in year x expressed as a fraction of labor required in 1980.

$V_x$ = mail volume projected for a specified future year x.

$V_{1980}$ = mail volume in 1980, the base year.

LP = labor productivity index for future year x, where $LP_{1980} = 1.0$.

VC = variable cost component of total labor cost or of total cost for a specific employee group.

SOURCE: Office of Technology Assessment.

## Appendix D

# E-COM Interconnection Arrangements[1]

## Dial-Up Access Arrangements

1. Binary synchronous, compatible with the IBM 2780 and 3780 terminals using EBCDIC character code sets, operating in half-duplex mode at 2400 bits per second with Bell System 201C compatible modems and at 4800 bits per second with Bell 2088 compatible modems.

2. Asynchronous, using the Texas Instruments 700 series convention for data block transmission and the 96 character ASCII subset as defined by ANSI Standard X3.4—1977, currently used in a wide variety of message and data terminals, operating at 300 and 1200 bits per second full-duplex with Bell System 212A compatible modems.

## Dedicated Access Arrangements

1. Packet switched X.25, with LAP data link protocol, binary synchronous framing using the ASCII character set, and full-duplex operations at 2400, 4800, or 9600 bits per second.

2. DEC (Digital Equipment Corporation) DDCMP serial synchronous byte oriented line protocol, using the ASCII character set, with full-duplex operation at 2400, 4800, 9600, or 56,000 bits per second.

3. Binary synchronous, compatible with the IBM 2780 and 3780 terminals using EBCDIC character code sets, operating in half-duplex mode at 2400 bits per second with Bell System 201C compatible modems and at 4800 bits per second with Bell System 208B compatible modems, and at 9600 bits per second with Bell System 209A compatible modems.

4. Asynchronous, using the Texas Instruments 700 series convention for data block transmission and the 96 character ASCII subset as defined by ANSI Standard X3.4—1977, currently used in a wide variety of message and data terminals, operating at 300 and 1200 bits per second full-duplex with Bell System 212A compatible modems.

---

[1] USPS; see *Federal Register*, vol. 46, No. 199, Thursday, Oct. 15, 1981, p. 50879.

# Index

# Index

American Telephone and Telegraph (AT&T), 78
automation, 27, 30

Communications Act (*see* Communications Act of 1934)
Communications Act of 1934, 3, 11, 16, 17, 76, 77, 80, 87, 88, 89, 94, 96, 97
competition, 17, 18, 91
  in data processing and office automation technologies, 30
  in EMS market, 16
  impact of private delivery services on USPS, 73
  restrictions on USPS, 77
  between USPS and private industry, 76, 87-88
computer modeling, 3, 18
  equation for labor requirements, 107
  limitations of, 19
  logistic substitution process, 105-106
  market penetration model, 19, 23-24, 101-104
  revenue and cost model, 19, 51-52
computers, 4, 16, 27, 30, 31, 32, 42, 44, 79, 87, 88
Congress, 3, 4, 75
  concern over USPS role in electronic mail and message systems, 17-18
  House Committee on Energy and Commerce, 17
  House Committee on Post Office and Civil Service, 17
  House Government Operations Subcommittee on Government Information and Individual Rights, 77
  possibilities for action by, 9-11, 87-97
  proposed legislation, 17, 18, 77, 95
  Senate Committee on Commerce, Science, and Transportation, 17
  Senate Committee on Governmental Affairs, 17
  Subcommittee on Government Information and Individual Rights, 77
Consultative Committee for International Telephone and Telegraph, 30
cross-subsidization, 18, 75, 88, 95

Datapost, 27
data processing, 17, 18, 27, 30, 87
Department of Commerce, 17, 75, 88, 95
Department of Justice, 9, 17, 62, 74, 75, 88, 95
deregulation
  of the telecommunication industry, 87
Dialcom, Inc., 78
Domestic Mail Classification Schedule, 92

E-COM (*see* electronic computer-originated mail)
EFT (*see* electronic funds transfer)
electronic computer-originated mail (E-COM), 3, 4, 9, 10, 11, 16, 27, 53, 74, 76, 77, 79, 81, 83, 88, 89, 90, 93, 95, 97
  capital cost of, 75
  establishment of a separate USPS office for, 96
  initiation of service, 17
  interconnections with telecommunication providers, 78, 92, 108
  legal challenge to USPS role in, 17
  projected growth of, 93
  regulation of, 94-95
  technical standards of, 78
  volume of, 75
electronic funds transfer (EFT), 4, 5, 6, 8, 16
  diversion of first-class mail to, 4, 5, 6, 26-27
  Generation III systems, 4, 5, 11, 81
electronic mail and message systems (EMS)
  alternatives for involvement of USPS in, 9, 10
  competition between Generations II and III systems, 77-78
  congressional interest in, 17-18
  cost displacement by, 9
  diversion of first-class mail to, 6
  effects on USPS finances, 90
  effects on USPS labor requirements, 7-8, 64-70, 90
  effects on USPS postal rates, 5-6, 61-63
  effects on USPS service levels, 5-8, 63-64
  fairness of USPS role in, 73-75
  Generation I systems, 77
  Generation II growth and timing estimates, 29-30, 32-33, 45-48
  Generation II systems, 4, 5, 6, 7, 8, 9, 10, 27, 29, 30, 31, 32, 33, 37, 38, 39, 40, 41, 42, 44, 45, 46, 52, 53, 56, 61, 62, 64, 66, 68, 69, 77, 81, 88, 89, 90, 94
  Generation III systems, 4, 5, 8, 9, 10, 11, 27, 30, 31, 32, 37, 38, 42, 44, 45, 46, 77, 78, 81, 83, 88, 91, 94
  growth of Generation III services, 30-31
  legality of USPS role in, 76
  marketing of, 92
  market penetration analysis of, 37-48
  penetration potentials of, 27
  performance standards for, 93
  policy implications of, 8-11
  projected growth of, 4-5
  relationship between Generation II and III estimates, 31-32
  revenue and cost assumptions, 56
  revenue and cost model analysis of, 51-57
  stimulation of demand for new messages by, 42
electronic message market, 16
electronic message service system (EMSS), 9, 16, 32, 53, 90, 93, 97
EMS (*see* electronic mail and message systems)
EMSS (*see* electronic message service system)
Equitable Life Assurance Co., 83

FCC (*see* Federal Communications Commission)
Federal Communications Commission (FCC), 10, 16, 77, 78, 87, 88, 93, 94, 95
  *Computer II* decision of, 76
Federal Express, 73
Federal Financing Bank, 74

Federal Property and Administrative Services Act of 1980, 87

Government Printing Office, 83
Graphnet, 78
greeting cards, 27, 32
GTE Telenet, 78

INTELPOST, 16
international electronic post (*see* INTELPOST)
International Standard Organization, 30
ITT World Communications, 78, 83

judicial delay, 10

mail (*also see* mailstream)
  advertising, 27, 31
  content categories, 24
  covers, 80
  financial statements, 31, 32
  first-class, 6, 56
  greeting cards, 31
  growth of volume, 33-34
  sender/receiver pairs, 24
  volume of, 4-5
Mailgram service, 3, 4, 9, 16, 27, 52, 89, 90, 93, 97
mailstream
  baseline, 24-25, 101-104
  EFT penetration of, 4, 26-27
  EMS penetration of, 4-5, 27-33
  growth of, 4, 6, 33-34
  percent as first-class mail, 6
  vulnerability to penetration by electronic mail systems, 24-25
Merrill Lynch Pierce Fenner & Smith, 83

National Research Council (NRC), 96
National Technical Information Service, 83
Netword, Inc., 83

Office of Management and Budget, 76, 77
Office of Technology Assessment (OTA), 3, 4, 5, 7, 8, 9, 11, 26, 29, 30, 31, 33, 42, 44, 45, 46, 51, 52, 53, 56, 57, 62, 63, 64, 65, 66, 68, 69, 75, 81, 88, 97
Omnibus Budget and Reconciliation Act of 1981, 52, 75
Opinion Research Corporation, 93

Paperwork Reduction Act of 1980, 87
Personal Computer Network, 27
Postal Act (*see* Postal Reorganization Act of 1970)
Postal Rate Commission (PRC), 9, 10, 17, 45, 52, 62, 76, 78, 87, 88, 90, 91, 92, 93, 94, 95
  hearings of, 75
postal rates
  implications of Generation II systems growth for, 61-63
Postal Reorganization Act of 1970, 3, 10, 11, 17, 45, 62, 74, 75, 80, 87, 88, 89, 93, 96, 97
  as authority for USPS involvement in EMS, 76
Postal Service (*see* United States Postal Service)
Postmaster General, 16
privacy protection, 10, 88, 93, 96
  data encryption, 81
  of electronic communication, 80-82
  and EMS, 79-81
  of sealed mail, 79
Private Express Statutes (PES), 10, 42, 73, 87, 89, 93
Purolator Corp., 73

RCA, 5, 9, 10, 32, 46, 53, 69, 79, 90, 91, 93
regulation, 11, 93-96

Satellite Business Systems, 78
security (*see* privacy protection)
Shell Oil Co., 83
Supreme Court, 79
Survey Research Center, 18, 24

telecommunication, 17, 18, 77, 80, 87, 89, 91, 92, 95
telecommunication and computer industries, 3
  effects of a USPS role in EMS on, 73-80
Telecommunications Deregulation and Competition Act of 1981, 18
teletext (*see* viewdata/teletext)
TRT Communications Corp., 83
TRT Telecommunications Corp., 78
Tyme-Gram service, 27
Tymnet, 78

United Parcel Service, 73
United States Postal Service (USPS)
  alternatives for involvement of, in EMS, 9, 10
  annual appropriations for, 74
  constraints on, 97
  contribution of first-class mail to fixed costs of, 6, 56
  cost and ratesetting process, 75
  disputed role of, in EMS and E-COM, 3, 78-79
  effects of reducing mail deliveries by, 5-8, 82
  innovation stimulated by, 79
  introduction of E-COM by, 3
  jurisdictional conflicts with other Federal agencies, 88
  labor-intensiveness of, 64
  labor requirements of, 7-8, 64-70
  legal mandates of, 3, 60, 76, 79, 82, 87
  long-term viability of, 11, 81-83
  performance of, 15-16
  public service subsidy, 75
  rates and service levels of, 5-6
  role in EMS, 9, 10, 17
  service levels of, 63-64
  tax-exempt status of, 74

United States Treasury
  loans to USPS, 74
University of Michigan, 18, 24, 33
viewdata/teletext, 4, 16, 27, 31

Western Union, 3, 16, 76, 78, 89, 90, 91, 94

## Office of Technology Assessment

The Office of Technology Assessment (OTA) was created in 1972 as an analytical arm of Congress. OTA's basic function is to help legislative policymakers anticipate and plan for the consequences of technological changes and to examine the many ways, expected and unexpected, in which technology affects people's lives. The assessment of technology calls for exploration of the physical, biological, economic, social, and political impacts which can result from applications of scientific knowledge. OTA provides Congress with independent and timely information about the potential effects—both beneficial and harmful—of technological applications.

Requests for studies are made by chairmen of standing committees of the House of Representatives or Senate; by the Technology Assessment Board, the governing body of OTA; or by the Director of OTA in consultation with the Board.

The Technology Assessment Board is composed of six members of the House, six members of the Senate, and the OTA Director, who is a nonvoting member.

OTA currently has studies underway in 11 general areas: energy, international security and commerce, materials, food and renewable resources, health, biological applications, communication and information technologies, oceans and environment, and space, transportation, and innovation.